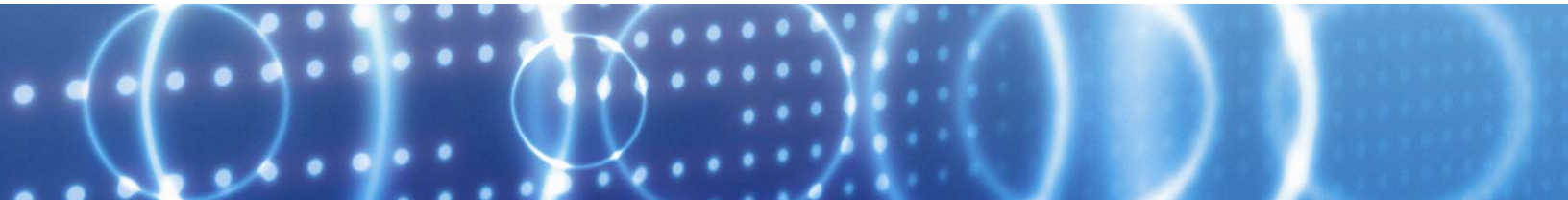


# D400 Substation Data Manager

Software Configuration Guide

SWM0066

Version 2.75 Revision 0



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# About this Document

## Purpose

This manual provides detailed information on how to configure the D400 software. Although this document describes all the configurable software applications in the D400, only the applications you purchased for your D400 will be available to you.

## Intended Audience

This document is a helpful resource for utility personnel and system engineers who are implementing the D400 in an overall substation automation system, and protection engineers who are controlling network devices. It is intended for readers who have knowledge of substation automation equipment and applications.

## Additional Documentation

For further information about the D400, refer to the following documents.

- *D400 Substation Data Manager User's Manual* (994-0089)
- D400 online Help (includes D400 configuration tool online Help)
- IEC 61850 Loader online Help

## How to Use this Guide

This guide describes how to configure the D400 software. The D400 employs sophisticated applications that contain many advanced features and capabilities. To successfully configure and operate the D400 for your substation environment, it is highly recommended that you work through this manual as follows:

1. Read chapter 1, *About the D400* to familiarize yourself with the D400 and software.
2. Read chapter 2, *Configuration Overview* to understand the approach to configuring the D400, including the tools and configuration procedure.

3. Read chapter 3, *Setting Up Communications* for information on configuring the serial and network connections to devices and master stations.
4. Refer to chapter 4, *Configuring Devices* for detailed information on how to configure the D400 to communicate with devices.
5. Refer to chapter 5, *Configuring Masters* for detailed information on how to configure the D400 to communicate with master stations.
6. Refer to chapter 6, *Configuring D400 Automation Applications* for detailed information on to configure specialty applications on the D400.
7. Refer to chapter 7, *Creating One-Line Diagrams* for a description of the drawing tools and configurable objects available in the One-Line Designer.
8. Refer to chapter 8, *System Utilities* for information on accessing and using the D400 command line functions to configure the D400.
9. The appendices of this document provide additional information on configuring advanced features of your D400 – for example, remote authentication and system redundancy.

If you need assistance, contact GE Energy Customer Service. See *Product Support* for contact details.

In configuration tables, “N/A” in the “Default” column indicates there is no default setting provided, and “X” indicates the number is automatically incremented.

### Document Conventions

This manual uses the Systeme International (SI) and the *Microsoft® Manual of Style* as a basis for styles and conventions.

The following typographic conventions are used throughout this manual.

**Bold** face is used for:

- Names of software program menus, editors, and dialog boxes; also for the names of menu commands, keyboard keys, icons and desktop shortcuts, and buttons and fields in editors and dialog boxes
- Names of hardware components
- User input that must be typed exactly

*Italic* face is used for:

- Emphasis
- Cross-references to sections, figures and tables within this manual and for titles of other documents
- File and directory names; examples of directory paths are generally given in the Windows form
- Placeholders for user input that is specific to the user. May also include angle brackets around the placeholder if the placeholder is already in italic text. For example, c:\<product>\product.def
- References to a setting or field value shown

The software-related procedures in this guide are based on using a computer running Windows® XP. Some steps and dialog boxes may vary slightly if you are using another version of Windows.

# Product Support

If you need help with any aspect of your GE Energy product, you have a few options.

## Search Technical Support

The GE Energy Web site provides fast access to technical information, such as manuals, release notes and knowledge base topics. Visit us on the Web at:

[http://www.gepower.com/prod\\_serv/products/substation\\_automation/en/tech\\_support\\_login.htm](http://www.gepower.com/prod_serv/products/substation_automation/en/tech_support_login.htm)

## Contact Customer Support

The GE Energy Customer Service Center is open 24 hours a day, seven days a week for you to talk directly to a GE representative.

In the U.S. and Canada, call toll-free: 1.800.361.3652

International customers, please call: +1 403.214.4600

Or e-mail to [ge4service@ge.com](mailto:ge4service@ge.com)

Have the following information ready to give to Customer Service:

- Ship to address (the address that the product is to be returned to)
- Bill to address (the address that the invoice is to be sent to)
- Contact name
- Contact phone number
- Contact fax number
- Contact e-mail address
- Product number / serial number
- Description of problem

The Customer Service centre will provide you with a case number for your reference.

### **Upgrade Your D400 Firmware**

The firmware of your D400 can be upgraded to provide the latest functionality and improvements. Visit the Customer Support website to download the upgrade software and instruction guide.



# 1

## About the D400

---

### 1.1 Overview

The D400 is a SCADA gateway device that encompasses the functionality of several typical substation devices in one. It can carry out a variety of functions, including:

- Data concentration – collect data from intelligent electronic devices (IEDs) installed in the substation
- Data presentation – present collected data to a Supervisory Control and Data Acquisition (SCADA) system
- Annunciator – monitor devices for alarm conditions and issue alarms to the operator for action
- Substation HMI – visually present the substation in one-line diagrams and display communications data to a system operator to monitor, control and operate the substation locally, or remotely over a network
- Terminal server – provide transparent access (also known as pass-through) to connected devices using vendor-supplied PC programs

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### 1.2 How the D400 Works

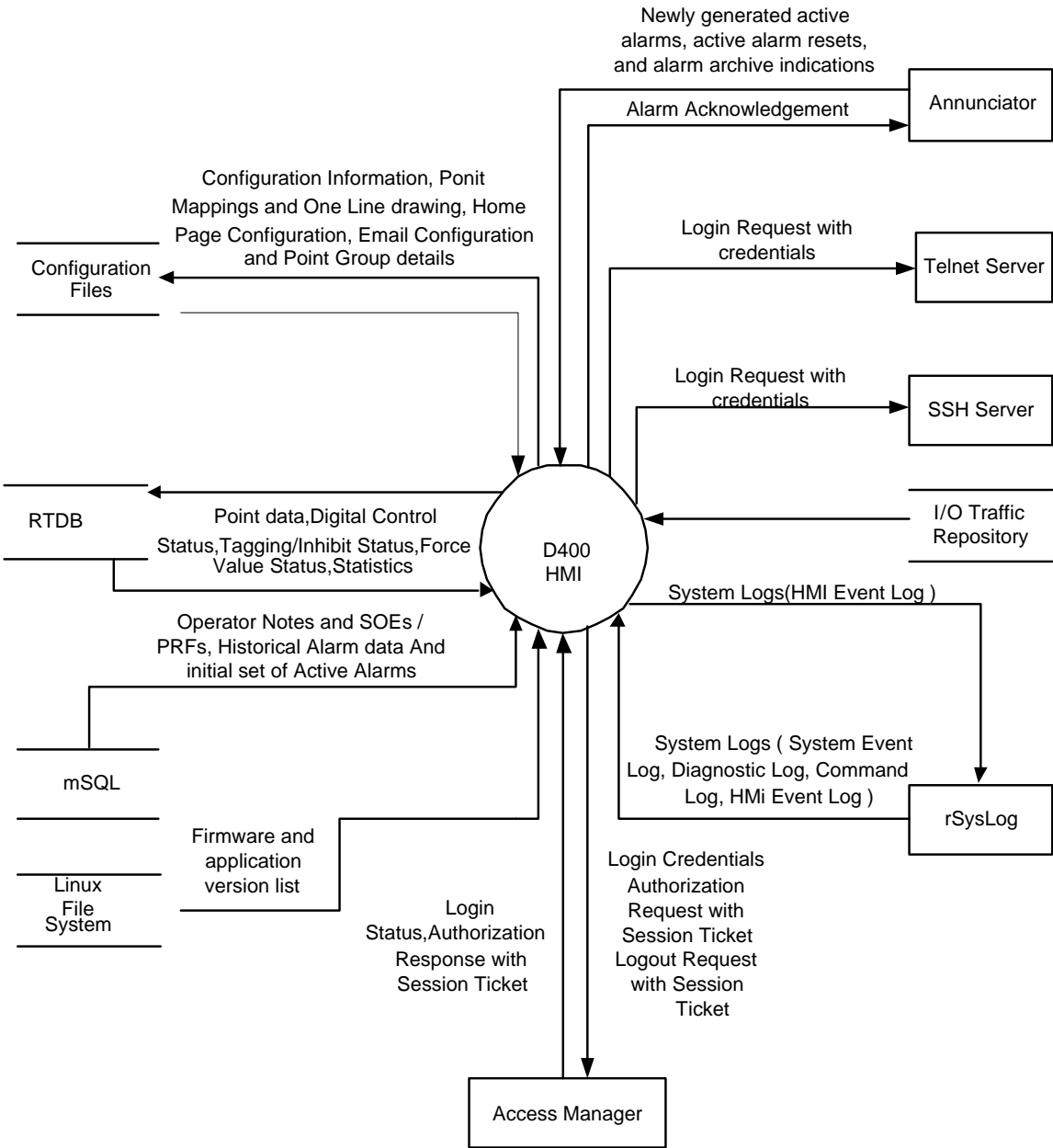
The primary function of the D400 is to concentrate substation data by polling and receiving information from connected IEDs (Intelligent Electronic Devices). Each device communicates data to the D400 through a serial or Ethernet network connection using a selected protocol. The D400 retrieves point information from and sends control requests to each communicating device.

The D400 can manipulate the data from devices to produce additional local/pseudo data points. The real data collected from devices and the calculated data are stored

in a database in the D400 and are available to pass on to SCADA master stations and/or HMI (Human-Machine Interface) applications.

The D400 is able to accomplish these tasks through the use of embedded software applications running on the Linux operating system. You configure these software applications to set up the D400 to operate as your system requires.

Figure 1 D400 HMI Overview



---

## 1.3 Types of Applications

The D400 makes use of three types of embedded software applications to collect, present and manipulate data. These are called client, server and automation applications respectively. The input and output data of these applications is stored in a real-time database, commonly referred to as the System Point Database.

### Client Application

This type of application typically interfaces with a substation device over a communications channel, and collects data points from it. The client application writes input point values to the real-time database and may process control requests. Known previously within GE embedded devices as a Data Collection Application (DCA).

### Server Application

This type of application typically allows a GE Energy gateway device to communicate with a master station or host computer over a communications channel. The server application reads input point values from the real-time database and sends control requests to it. Known previously within GE embedded devices as a Data Presentation Application (DPA).

### Automation Application

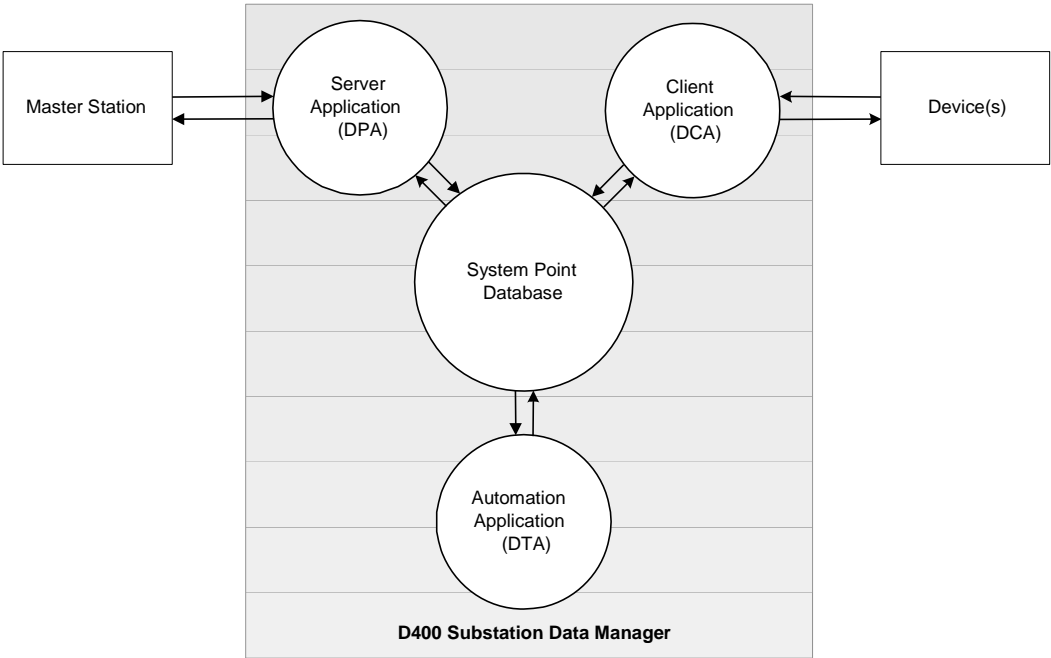
This type of application manipulates data within the real-time database. The automation application has the ability to examine the status of defined input points in the real-time database and accept control requests from server applications or other automation applications. The automation application is able to process this data and then update the values of the digital inputs and analog inputs owned by the automation application or output points belonging to another application. Known previously within GE embedded devices as a Data Translation Application (DTA).

### System Point Database

Information collected by the D400 is stored in a central database on the D400 called the System Point Database. The database is a SQL Server database and includes all types of system information, including communication statistics, present values, peak values and event records. The real-time database is dynamically updated for all the D400 system inputs/outputs as substation events take place and information is exchanged between applications.

Figure 2 illustrates a simplified relationship between the three application types and the system point database within the D400.

Figure 2 Data Applications Within the D400



## 1.4 D400 Applications

Table 1 lists the configurable applications that are available for the D400. The applications available to you depend on your D400 purchase and configuration. You set up and run the applications using a variety of tools and utilities that are provided with the D400.

Table 1 List of D400 Applications

Client	Server	Automation	Tools/Utilities
DNP3	IEC 60870-5-101+104	Alarm	Runtime HMI
IEC® 60870-5-101	DNP3	Calculator	Configuration Tool
IEC 60870-5-103	MODBUS	LogicLinx* (optional)	System Utilities
IEC 61850 (optional)			System Point Database
Hydran*			HMI Access Manager
SEL Binary			User Management
MODBUS®			One-Line Designer & Viewer (optional)
			IEC 61850 Loader (optional)

## 1.5 About the DNP3 Software

The DNP3 (Distributed Network Protocol) software in the D400 is layered to be consistent with the International Electrotechnical Commission (IEC) Enhanced Protocol Architecture (EPA).

The protocol software comprises a Physical Layer, Data Link Layer and Application Layer. Both the DNP3 client and server applications implement the Application Layer and Data Link Layer and support the serial Physical Layers. The Ethernet layer is implemented using separate software, the DNP3 Transport Layer application.

**Figure 3 EPA Layers for the DNP3 Software**

	D400 System Point Database
-----	
<b>Application Layer</b>	DNP3 client and server
-----	
<b>Data Link Layer</b>	DNP3 client and server
-----	
<b>Physical Layer</b>	DNP3 Transport applications (client and server)
-----	

# 2

## Configuration Overview

To get the D400 up and running in your substation automation system, you need to configure it for device communications, SCADA master communications, and substation monitoring and control functions. In particular, you may want to customize the following aspects of the D400:

- Communication connections
- Device data collection
- Master Station data presentation
- Alarm annunciation
- Data calculation
- Data logging
- Operational (one-line) diagrams (optional)
- User management
- HMI preferences
- E-mail notification

The D400 includes a variety of tools to help you set up the D400 to operate in your substation automation system, including:

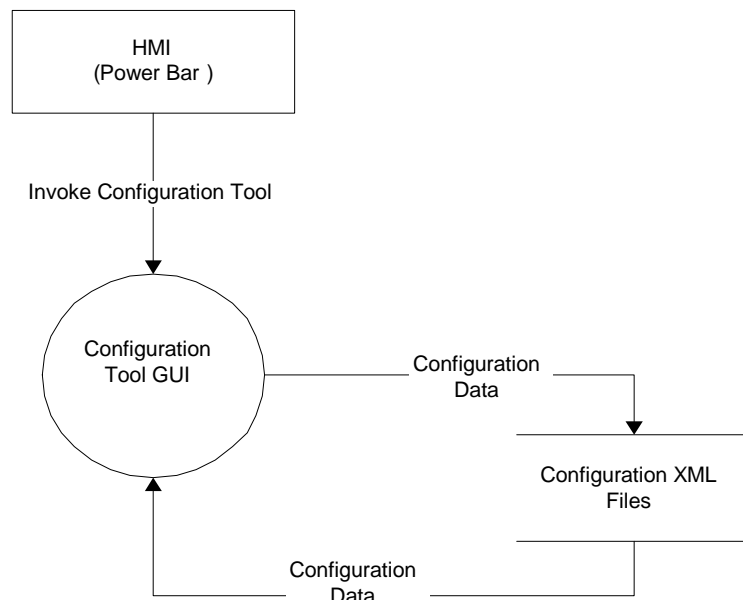
- D400 Online Configuration Tool
- One-Line Designer
- IEC 61850 Loader and LogicLinX (optional)
- D400 System Utilities

This chapter gives an overview of each tool and the basic steps to configuring the D400.

## 2.1 D400 Online Configuration Tool

The D400 Online Configuration Tool is used to create, edit and update the software configuration of the D400 while it is in operation. The Online Configuration Tool is a component of the D400 HMI.

**Figure 4 D400 Configuration Tool Interface**



You use the D400 Online Configuration Tool to:


- Set up D400 communications to devices and masters (serial or network connections)
- Select and/or create point maps (for devices and masters)
- Configure alarms
- Create custom data calculations
- Set system preferences
- Manage user accounts
- Create one-line diagrams

Although you are configuring the D400 while it is online, your configuration changes do not take effect until you “commit” the changes. Once a configuration is committed, it is validated and copied to the system disk and the D400 applications are restarted.

### One-Line Designer

The One-Line Designer is a specialized drawing tool for creating substation one-line diagrams and forms, such as an annunciator panel. The One-Line Designer is accessed from within the D400 Online Configuration Tool.

## >> To start the online configuration tool

- Log into the D400 HMI and click the **Configuration** button  on the Power bar. You must have Supervisor privileges to access the configuration tool. Only one Supervisor user at a time can be logged in to perform configuration functions.

This manual provides detailed information on the configurable settings in the D400, and how to configure the D400 to work with different aspects of the substation system.

For more information about using the D400 Online Configuration Tool, functions and screens refer to the D400 online Help.

---

## 2.2 IEC 61850 Loader (optional)

The IEC 61850 Loader (referred to as the Loader) is a PC-based software program that is specifically designed to configure the D400 to communicate to IEC 61850 compliant server devices using the D400's IEC 61850 client application. The Loader makes use of the self-description capabilities of the IEC 61850 protocol and device information files provided by most devices to simplify and speed up configuration of the IEC 61850 client application.

Using the Loader, you create the client configuration that identifies the devices, points and polling information required to set up communications between IEC 61850 devices and the D400. Once you are finished configuring the IEC 61850 client using the Loader, you download it to the D400 directly from the Loader.

For more information on using the IEC 61850 Loader, see the Loader online Help.

---

## 2.3 LogicLinx (optional)

LogicLinx is a tool that enables you to create automation applications that have traditionally been too costly or difficult to implement – all without hard-wiring. Using any or all of the IEC 61131-3 programming languages, you can create automation routines that run on your D400.

LogicLinx automation routines are created using the LogicLinx editor. The LogicLinx Wizard within ConfigPro CCE is then used to configure and upload the LogicLinx application to your D400.

For more information on using LogicLinx, refer to the *LogicLinx on D400 Quickstart Guide* (SWM0069).



---

## 2.4 D400 System Redundancy

The D400 redundancy solution provides warm standby functionality using two D400s connected through a serial link – one in active mode and one in standby mode. If the active unit fails, the standby unit becomes active and takes over system operation.

D400 system redundancy is configured and enabled through several software applications that run on each redundant D400 unit. Hardware configuration is required as well; refer to the *D400 Substation Data Manager User's Manual* and appendix B *System Redundancy* for more information.

### D400 Redundancy Manager

The D400 Redundancy Manager is responsible for managing communications between the two D400 units and the RS232 switch panel. It also controls data synchronization and state changes.

For more information, see section 6.5 *D400 Redundancy Manager*.

### Redundancy Serial Port Settings

Two serial ports on each D400 are dedicated to redundancy-related communications:

- **Redundancy Dedicated Link** - Links the two D400 units together through the ping cable. See *Redundancy Dedicated Link* in section 3.1 *Serial Connections*.
- **Redundancy Switch Panel** - Connects each D400 unit to the RS232 switch panel through the watchdog cable. See *Redundancy Switch Panel* in section 3.1 *Serial Connections*.

### D400 Configuration Manager

The D400 Configuration Manager allows you to synchronize configurations between two D400 units. The D400 redundancy application uses this tool to manage the synchronization of configuration files between the active and standby units to ensure both units are configured identically.

For more information, see section 8.7 *D400 Configuration Manager*.

### D400 Configuration Utility – Redundancy

The D400 Configuration Utility is a tool accessed through the command line of the D400. The Redundancy section of this utility is used to configure the parameters of the redundancy application.

For more information, see *Redundancy* in section 8.3 *D400 Configuration Utility*.

---

## 2.5 D400 System Utilities

Configuration information related to the D400 system is changed using utility programs that are installed on the D400 platform. You can access these system

utilities directly at the D400 command prompt through the local maintenance port or remotely through the Utilities Power bar button in the D400 HMI.

The D400 system utilities are typically used during the initial setup of the D400 and for changing the basic configuration of the system, including the network connections, system date and time, and administrator passwords.

For more information on using the D400 System Utilities, see chapter 8, *System Utilities* and also the *D400 Substation Data Manager User's Manual*.

---

## 2.6 Configuration Steps

The typical sequence of steps to configure the D400 to operate in a substation automation system is as follows:

1. Set up network and system settings using the D400 System Utilities.
2. Create and/or edit Client (device) maps using the configuration tool.
3. Set up device (serial and network) connections, including protocol-specific settings.
4. Program Automation applications.
5. Create and/or edit Server (master station) maps.
6. Set up master station connections, including protocol-specific settings.
7. Create substation one-line diagrams using the One-Line Designer.
8. Save the configuration file.
9. Run the configuration file on the D400 by committing the changes.

---

## 2.7 Configuration File Format

Configuration information for an individual D400 is stored as a set of XML files. The configuration files are labeled with the D400 device name and saved to the User CompactFlash disk on the D400 main board.

The configuration files contain the following information:

- Device and master point maps
- Application settings
- HMI settings

Configuration information for each application, is also contained in the configuration files, including the application version, configuration settings, default settings and saved user settings.

System configuration information that is modified using the system utilities is stored in separate system configuration files stored on the D400. The system configuration files are updated each time changes are made.

---

## 2.8 Configuration Management

While you are creating and editing the D400 configuration using the D400 configuration tool, your settings are saved in a temporary file and location. When you are ready to run the new configuration in the D400, you “commit” the changes. The configuration tool validates your changes against the XML schema and reports any errors. Once a configuration is validated and committed, the previous configuration file is archived, the new file is copied to the system disk and the D400 applications are restarted.

The following chapters describe how to configure the D400 for various substation applications.

# 3

## Setting Up Communications

The D400 supports communication connections for devices and master stations on two types of interfaces:

- Serial
- Network

The number of serial ports and Ethernet cards available for configuration depends on the hardware configuration of the D400. Refer to the *D400 Substation Data Manager User's Manual*.

The D400 supports up to 128 connected devices in total.

### Communication Statistics

The D400 maintains communication statistics and other status information for connected devices and master stations in the system point database as pseudo points.

This chapter describes how to set up serial and network connections for devices and master stations.

Settings for the communication connections are available on the **Connection** tab of the **Configuration** page in the D400 configuration tool. Both devices and master station connections are set up on the same tab for the desired type of connection.

---

## 3.1 Serial Connections

You can configure up to 16 serial connections. These connections can be one of the following:

- Point to Point Device
- Multi-drop Device
- Serial Master Station

Each serial port can be assigned a single device protocol (client application) for device communications.

### Serial Connection Redundancy

Communications that take place over a serial connection can be configured for redundancy by setting up two serial ports – a primary port and a secondary (back up) port. Communications will normally take place over the primary port. In the event of a loss of communication with the device over the primary port, the D400 will try to re-establish communication over the secondary port.

### Multi-Drop

Some devices support a daisy-chain connection in which multiple devices are wired together from one to the other. A multi-drop configuration requires additional configuration to set up each individual device on a multi-drop connection.

### SCADA Communications

The D400 supports serial connections to SCADA masters through up to four serial ports. Each serial port can be assigned a single SCADA protocol (server application) for master station communications. The D400 currently supports serial master communications using the DNP3 and Modbus server protocols.

### Other Connections

Connections for a serial line printer, a terminal server, and a LogicLinX device can be configured.

### Adding a Serial Connection

You manage the serial connections on the D400 on the **Connection** tab on the **Configuration** page.

A client map file must be available in the D400 before a protocol type is available for configuration. The D400 includes several default client maps. If you require a custom map, create it first before setting up the serial connection. See section 4.2, *Client Maps*.

## » To add a serial connection

- On the **Configuration** page, click the **Connection** tab, then click **Add Connection** and configure a connection for each serial port.

Each row under the **Serial** heading of the Connections pane represents one connection through an RS-232 or RS-485 serial port on the D400. The port numbers correspond to the port numbers on the rear of the D400 unit. See the *D400 Substation Data Manager User's Manual*. You can configure a maximum of 16 ports.

Each serial connection can be configured for device (client) or master station (server) communications using a selected protocol. The type of connection and the protocol you select determine the client or server application and related settings that will be used for the communications on that serial port. See Table 2.

### Port Settings

The following settings are required for each connection; they define how the D400 communicates over the serial link. Some settings may not be available for all connection types.

**Table 2 Port Settings**

Setting	Description	Range	Default
Primary Port	Primary serial port for device communications with the D400.	1 to 16	Incremented from 1.
Backup Port	Secondary port for device communications if the primary port fails. The Backup port automatically takes on the settings of the associated Primary port.	1 to 16	N/A
Baud Rate	The speed of information being transmitted across the serial connection, in bits per second (bps).	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	9600
Parity	A bit added to a group of bits to detect the presence of an error.	Even None Odd	None
Data Bits	Number of bits used for each character.	7, 8	8
Stop Bits	Number of bits used to indicate the end of each character as it is transmitted.	1, 2	1

*RTS and CTS Values*

Some protocols may require these parameters to be configured.

**Table 3 RTS Values**

Setting	Description	Range	Default
Flow Control	Specifies whether or not RTS Flow Control is enabled	Enabled Disabled	Disabled
Pre-Trans Delay	Specifies the time (in milliseconds) that RTS is asserted before data is transmitted. Also known as the RTS preamble.	1 to 65535	15
Post-Trans Delay	Specifies the time (in milliseconds) after data is transmitted that RTS is held asserted. Also known as the RTS postamble.	1 to 65535	15

**Table 4 CTS Values**

Setting	Description	Range	Default
Flow Control	Specifies whether or not CTS Flow Control is enabled	Enabled Disabled	Disabled

*Dial-up Modem Settings*

The following settings are required when configuring a Dial-up Modem link.

**Table 5 Modem Settings**

Setting	Description	Range	Default
Init String	The data string sent to the modem when the application starts.	1 to 64 ASCII characters, no spaces	ATZ
Attention String	The data string sent to the modem to place it into command mode.	1 to 32 ASCII characters, no spaces	+++
Hang Up String	The data string sent to the modem to cause it to hang up the phone connection.	1 to 32 ASCII characters, no spaces	ATH
Retry Count	How many times to retry a failed connection before giving up. Increase the value for unreliable connections.	0 to 30	3
Retry Delay (sec)	The amount of time to wait, in seconds, between retry attempts.	0 to 3600	3 (Client) 30 (Server)
Idle Wait Time (sec)	The amount of time, in seconds, that must elapse without data transmission before the connection is terminated.	0 to 3600	10 (Client) 15 (Server)

Setting	Description	Range	Default
Auto Answer	Enable the modem to automatically answer incoming calls.	Enabled Disabled	Enabled

## Protocols

Serial connections can be configured using the following protocols.

- DNP3 Master Stations (p.24)
- DNP3 Multi-drop (p. 29)
- Hydran Multi-drop (p. 32)
- IEC 60870-5-101 Master Station (p. 32)
- IEC 60870-5-101 Multi-drop (p. 37)
- IEC 60870-5-103 Multidrop (p. 39)
- LogicLinx Device (p. 41)
- Modbus Master Stations (p. 41)
- Modbus Multi-drop (p. 42)
- Printer Device (p. 42)
- Redundancy Dedicated Link (p. 43)
- Redundancy Switch Panel (p. 43)
- Single Generic ASCII (p. 43)
- Single SEL Binary (p. 44)
- Terminal Server (p. 46)

## DNP3 Master Stations

The Distributed Network Protocol (DNP3) supports communication with one or more devices over dedicated serial links, as well as over Ethernet. The D400 supports communications to DNP3 devices using the DNP3 client application. It collects the point values from the devices based on the protocol and device settings and stores them in the system point database.

The DNP3 protocol is highly configurable. You have the option of configuring the way the DNP3 client application on the D400 behaves by modifying the DNP3 protocol settings, or use the default configuration settings.

The following settings are used when configuring a DNP3 Master Station. If a Modem connection is used, refer to the additional settings defined in Table 5.

**Table 6 DNP3 Master Stations**

Setting	Description	Range	Default
Name	Text description to identify the master station being connected to.	1 to 32 ASCII characters	MASTERX
Master Station Address	Unique DNP3 address of the server application instance.	0 to 65519	X

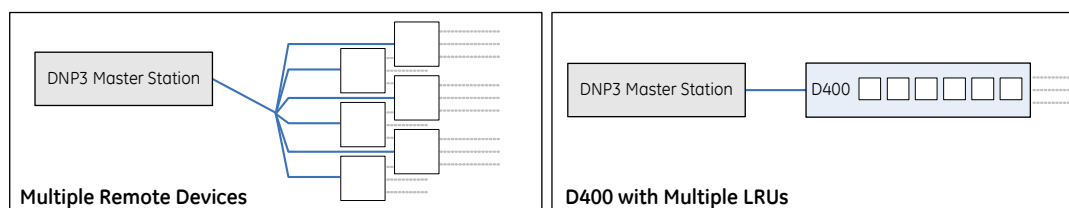


Setting	Description	Range	Default
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>DNP3 Server Application Parameters</i> .	Use Default Create New...	Use Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

### Multiple Logical Remote Units (LRU)

You can configure multiple logical remote units on a single or redundant serial connection. This allows a remote DNP3 master station to communicate with multiple logical remote units within a physical D400 unit using a single serial link. You can use multiple LRU functionality to test a system configuration without needing to connect to multiple physical devices.

**Figure 5 Multiple LRU Overview**

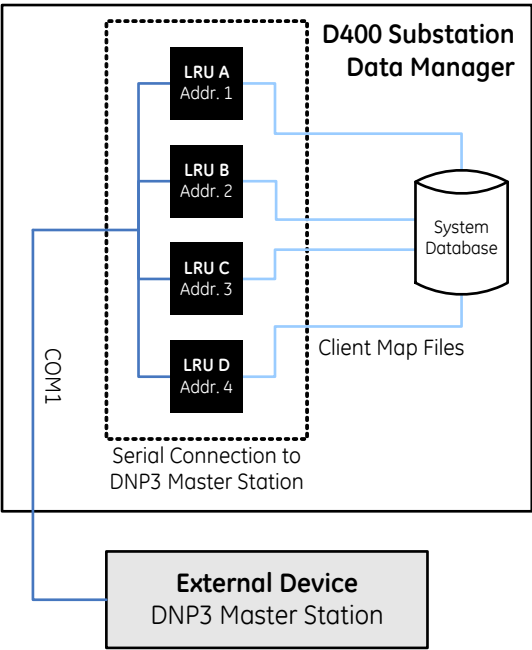


To add an LRU to communicate over a serial link with a DNP3 Master Station, click the **Add** button under *Configuration Parameters* and configure the row.

In the example below, a DNP3 Master Station is configured on serial port 1 of the D400. Under *Configuration Parameters*, four rows are added and configured as follows:

Name	D400 Address	Map File	Application Parameters	Auto Start Up
LRU A	1	LRUA.xml	Use Default	✓
LRU B	2	LRUB.xml	Use Default	✓
LRU C	3	LRUC.xml	Use Default	✓
LRU D	4	LRUD.xml	Use Default	✓

Figure 6 Example Remote LRU Configuration



In this example, the DNP3 master station can connect to each of the four LRUs through the serial connection (COM1). Each LRU has a unique DNP address so that they can be communicated with independently. Each LRU can reference the same or different server map file. If the same server map file is referenced by multiple LRUs, each of these LRUs will serve the same data to the remote DNP3 master station.

*DNP3 Server Application Parameters*

Regular and advanced DNP3 server settings are available under the **Application Parameters** field. See Table 7 and Table 8.

Table 7 DNP3 Server Communication Settings - Regular

Setting	Description	Range	Default
Application Retry	Number of times the DNP3 resends an unconfirmed application message before taking a degraded timeout.	0 to 300	2
Application Timeout	Time (in milliseconds) the DNP3 waits for the remote station to confirm an application message before re-sending it. Set the value much higher for a dial-up modem connection, i.e. 60000.	1 to 120000	6000

Setting	Description	Range	Default
Data Link Confirm	Defines when the DNP3 requests remote-station confirmation of a data link message.	Never Multi-fragment only Event only Event or Multi-fragment IIN only IIN or Multi-fragment Event or IIN Event, IIN or Multi-fragment Always	Never
Data Link Retry	Number of times the DNP3 Server resends an unconfirmed data link message before taking a degraded timeout.	0 to 300	2
Data Link Timeout	Time (in milliseconds) the DNP3 Server waits for remote-station confirmation of a data link message before re-sending it. Set the value higher for a dial-up modem connection, i.e. 60000.	1 to 120000	1000
Initial Master Address	DNP3 Server master address	0 to 65519	100
Degraded Timeout	Time (in milliseconds) the DNP3 Server delays between retry cycles when seeking confirmation of an application message.	1 to 7200000	5000
Transmission Fragment Size	Maximum size (in bytes) of an unsolicited application message or response message fragment (minimum is 249 bytes).	249 to 2048	2048
Accept Time Synchronization	Enable Time synchronization from Master	True False	True
Unsolicited Mode Class 1	Flag that enables or disables DNP3 Server unsolicited message support for class 1 events	True False	False
Unsolicited Mode Class 2	Flag that enables or disables DNP3 Server unsolicited message support for class 2 events	True False	False
Unsolicited Mode Class 3	Flag that enables or disables DNP3 Server unsolicited message support for class 3 events	True False	False
Unsolicited Poll Frequency	Frequency (in milliseconds) at which the DNP3 Server checks for unreported data.	1 to 120000	5000
Select Timeout	Time (in seconds) the DNP3 Server waits for an operate request before canceling the select.	0.1 – 65535	5.89

Setting	Description	Range	Default
RTS Flow Control Enabled	Flag that enables the RTS flow control signal. It is only used when communication is over Serial and is ignored for TCP or UDP network communications.	True False	False
RTS Preamble	RTS preamble time (in milliseconds). Used only when RTS Flow Control Enabled is set to True in Serial communication.	1 to 120000	20
RTS Postamble	RTS postamble time (in milliseconds). Used only when RTS Flow Control Enabled is set to True in Serial communication.	1 to 120000	20
Time Offset	Time offset (in minutes) from UTC. For example, for Eastern Standard Time, specify -300, which means UTC minus 5 hours. Specify only if the Master does not use UTC within DNP3 messages. DNP3 requires the time base to be UTC, but non-compliant Masters may use local time.	-1440 to 1440	0

The advanced settings listed in Table 8 are for adjustment by experienced system engineering personnel and project engineers deploying the product in a specified configuration. Typically, these settings should not require modification.

**Table 8 DNP3 Server Communication Settings - Advanced**

Setting	Description	Range	Default
Application Confirm	Defines when the DNP3 Server requests remote-station confirmation of an application message.	Never Multi-fragment only Event only Event or Multi-fragment IIN only IIN or Multi-fragment Event or IIN Event, IIN or Multi-fragment Always	Event, IIN or Multi-fragment
Internal Indication Confirm	Indicates whether local-station indications require confirmation on change in status.	Buffer Overflow None	Buffer Overflow
Reboot On Cold Start	Reboot D400 on receiving cold restart from Master.	True False	True
Response Fragment Size	Maximum size of a solicited application message fragment (minimum is 249 bytes).	249 to 2048	2048

Setting	Description	Range	Default
Report Comm-Failed As Offline	Determines if a D400 Data Point must be reported as Offline to the Master Station when the D400 COMM-FAILED quality attribute is set.	True False	True
Unsolicited Data	What information the DNP3 Server sends to the remote station in unsolicited messages.	Events and indications Indications only	Events and indications
Unsolicited Startup	Defines what data the DNP3 Server sends in the initial unsolicited startup message.	Events and indications Indications only	Indications only
Buffer Overflow Policy	Indicates whether the DNP3 Server discards newest or oldest event when a class event queue overflow occurs.	Discard Newest Discard Oldest	Discard Oldest
Internal Buffer Location	Specifies how to store the unreported events collected from Event Queues.	RAM NVRAM	RAM
Internal Event Buffer Capacity	Number of events that can be contained in the Internal buffer of the DNP3 Server.	512, 1024, 2048, 4096, 8192, 16384	2048
Class 1 Queue Max. Length	Maximum number of Class 1 Events that can be buffered. This can either be "Up to Capacity", or a Number. If a Number is entered, the sum Max. Lengths for all Class Queues cannot exceed the Internal Event Buffer Capacity.	512, 1024, 2048, 4096, 8192, 16384, Up to Capacity	Up to Capacity
Class 2 Queue Max. Length	Maximum number of Class 2 Events that can be buffered. This can either be "Up to Capacity", or a Number. If a Number is entered, the sum Max. Lengths for all Class Queues cannot exceed the Internal Event Buffer Capacity.	512, 1024, 2048, 4096, 8192, 16384, Up to Capacity	Up to Capacity
Class 3 Queue Max. Length	Maximum number of Class 3 Events that can be buffered. This can either be "Up to Capacity", or a Number. If a Number is entered, the sum Max. Lengths for all Class Queues cannot exceed the Internal Event Buffer Capacity.	512, 1024, 2048, 4096, 8192, 16384, Up to Capacity	Up to Capacity

### DNP3 Multi-drop

The following settings are used when configuring a DNP3 Multi-drop connection. If a Modem connection is used, refer to the additional settings defined in Table 5.

**Table 9 DNP3 Multi-drop**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Protocol address of the device (i.e. DNP3 device address)	0 to 65519	X
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

*DNP3 Client Application Settings*

DNP3 client settings are available under the **Application Parameters** field and apply to all multi-dropped devices.

**Table 10 DNP3 Client Application Settings**

Setting	Description	Range	Default
Master Address	Address of the DNP3 client application. Must be different from all configured devices on this port.	0 to 65519	1 (As per DNP3 convention)
IIN React Class1	True: Respond to "Class 1" IIN in a message by requesting class 1 event data. False: Ignore "Class1" IIN Class 1 Data events are typically very important and should be retrieved from the target device as soon as the indication is received	True False	True
IIN React Class2	True: Respond to "Class 2" IIN in a message by requesting class 2 event data. False: Ignore "Class2" IIN Class 2 Data events are typically very reasonably important and should be retrieved from target device as soon as the indication is received	True False	True

Setting	Description	Range	Default
IIN React Class3	True: Respond to "Class 3" IIN in a message by requesting class 3 event data. False: Ignore "Class3" IIN Some target devices generate large numbers of insignificant Class 3 events. To minimize I/O traffic, set to False.	True False	False
IIN React Time Sync	True: Respond to "Need Time Sync" IIN in a message by sending a "Time Sync" message. False: Ignore "Need Time Sync" message If a target device asks for a time sync, it should be given one, unless the target device has access to another clock than the D400	True False	True
Integrity Time Sync	True: Send out a "Time Sync" message to a target device each time an "Integrity Poll" message is sent to that device. False: Do not send out a "Time Sync" message to a target device each time an "Integrity Poll" message is sent to that device. In general, if a target device needs a time sync, it will ask for one. This setting should be used only if there is a known problem with the target device's clock.	True False	False
Stagger Integrity Enable	Specifies whether Staggered Integrity polling is enabled or not. True: The DNP3 client ignores the Integrity Poll Interval configured for the devices, and utilizes an internal scheduling mechanism to determine when the next integrity poll should be transmitted. False: Do not enable staggered integrity polling. Use the configured settings.	True False	False
Stagger Integrity Interval	If Staggered Integrity polling is enabled, the DNP3 client shall schedule Integrity polls to devices based on the interval (in seconds) specified here.	30 to 36000	600
Channel Switch Fail Count	Number of consecutive failed requests the DNP3 client must see before it attempts to establish communications on the Backup Port.	1 to 300	5
Device Offline Fail Count	Number of consecutive failed requests to a device before the RTDB points is marked offline.	1 to 300	5
Enable Concurrent Polling	Concurrent polling is currently not supported.	False	False
Wait Between Messages	Time (in seconds) to wait between two consecutive messages sent on the serial port	0 to 60	0.0

Setting	Description	Range	Default
Response Timeout	Time (in seconds) to wait for an application layer response before deciding it has failed. Set the value higher for a dial-up modem connection, i.e. 40.	0 to 60	2.0

### Hydran Multi-drop

The following settings are used when configuring a Hydran Multi-drop connection.

**Table 11 Hydran Multi-drop**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Protocol address of the device (i.e. DNP3 device address)	0 to 65519	X
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

### IEC 60870-5-101 Master Station

The following settings are used when configuring an IEC 60870-5-101 Master Station connection.

**Table 12 IEC 60870-5-101 Master Station**

Setting	Description	Range	Default
Transmission Mode	The link transmission mode used by the application	Balanced Unbalanced	Unbalanced
Link Address Size	The number of octets used for the link address of the LRU.	1 or 2	1
LRU Name	The name of the LRU/master station connection	1 to 32 ASCII characters	MASTERx



Setting	Description	Range	Default
Common Address of ASDU Size	The number of octets used for the common address of ASDU for the LRU.	1 or 2	1
Common Address of ASDU	The Common Address of ASDU for the LRU.	1 to 254 [1 octet size] 1 to 65534 [2 octet size]	1
Link Address	The link address of the LRU.	0 to 65535	1
Map File	Name of the server map file to be used with the specific LRU.	List of user configured server map files.	N/A
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>IEC 60870-5-101 Master Station Application Settings</i> .	Use Default List of user-customized application configuration files	Use Default
Auto Start Up	Indicates if the server application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

#### *IEC 60870-5-101 Master Station Application Settings*

IEC 60870-5-101 settings are available under the **Application Parameters** field for Master Stations.

**Table 13 IEC 60870-5-101 Master Station Application Parameters**

Setting	Description	Range	Default
<i>Application Tab</i>			
Info Object Address Length	The number of octets used by the LRU for information object addresses.	1, 2, or 3	2
Time Mode	Specifies if the master station is allowed to set or use the main D400 and/or local LRU time.	Set main/use main time Set local/use local time Set local/use main time	Set main/use main time
Time Sync Timeout	The maximum allowed time (in seconds) between time synchronization attempts from the IEC 60870-5-101/104 master station or other time source before time tagged data is reported as invalid by the LRU. Not used when set to 0.	0 to 86400	900

Setting	Description	Range	Default
Control Select Timeout	The maximum allowed time (in seconds) between control select and control execute commands (for digital and analog output points) from the IEC 60870-5-101/104 master station.	0.01 to 60.0	5.0
Double Point Valid Time	The minimum time (in seconds) that both digital input points must be stable before an ON/OFF state is reported.  Note: The value of this property only applies when the corresponding parameters of a double point information object are specified as undefined.  Not used when set to 0.	0 to 65535	500
Double Point Suppress Time	The minimum time (in seconds) that both digital input points must be stable before an indeterminate state is reported.  Note: The value of this property only applies when the corresponding parameters of a double point information object are specified as undefined.  Not used when set to 0.	0 to 65535	1000
LRU Event Buffer Size	The number of events (non-time-tagged, time-tagged, and hour update objects) that are buffered by this LRU.	50 to 65535	255
LRU Event Buffer Location	The location where unreported events that are collected from event queues are stored.	RAM NVRAM	RAM
Event Buffer Overflow Policy	Specify whether the newest or oldest events are discarded when the server event buffer is filled.	Discard Newest Discard Oldest	Discard Newest
Event Buffer Low Threshold	A percent value of the total event buffer. When the amount of available buffer space drops below this threshold, a server event buffer low indication is reported by the application.	10 to 100	20
DI Cancels Select	Specify whether digital output select requests are automatically cancelled when any digital input changes are detected.	Enabled Disabled	Disabled

Setting	Description	Range	Default
Buffer AI	Specify whether analog input changes (spontaneous, periodic, background scan) are buffered for reporting. When this is enabled, the LRU reports each analog change separately.  For example, if an analog input point exceeds the threshold 3 times before the LRU is polled for data in unbalanced mode, the LRU shall report all 3 value changes. If this feature is disabled, the LRU shall report only the most recent value.	Enabled Disabled	Disabled
Zero Threshold Reporting	Specify how the LRU should treat a zero value for the Threshold configuration parameter for an analog input.  If this setting is enabled, setting the threshold configuration parameter of an analog input point to zero (i.e. 0.0) spontaneously reports all changes for the point. If disabled, setting the Threshold configuration parameter of an analog input point to zero shall disable spontaneous reporting for the point.	Enabled Disabled	Disabled
Time Tagging	When to report time-tag data.  If configured as <i>Not on Interrogations</i> , the LRU reports a time tag only for spontaneous, periodic/cyclic, or background scan causes of transmission (that is, the LRU suppresses time tag for interrogated data). If configured as <i>Always</i> , the LRU reports time tag for all causes of transmission.	Not on Interrogations Always	Not on Interrogations
Clear Statistics	Specify if the application should reset all LRU statistics to zero at startup.	Enabled Disabled	Disabled
Comm Log Mode	The logging mode for all I/O communications traffic with the LRU.	Disabled ASCII Hex ASCII and Hex	Hex
Number of Files Supported	The number of information object addresses reserved for file transfer.  Not used when set to 0.	0 to 128	0
Time to Live	The time period (in seconds) a queued control command is to be treated as active in the system. If the configured value is 0, the RTBD setting is used.	0.0 to 60.0	0.0
Cause of TX Length	The number of octets used for the Cause of Transmission field.	1 or 2	1

Setting	Description	Range	Default
<i>Unbalanced Serial Link Tab</i>			
Max ASDU Frame Length	The maximum length (in octets) of non-background messages (excluding framing overhead).	24 to 255	255
Extra Frame Timeout	The time (in milliseconds) that the application adds to the frame timeout calculation.	0 to 65535	150
Single Char Acknowledge	Specify if the application should respond to the master station with a single character acknowledgement message.	Enabled Disabled	Disabled
Comm Fail Timeout	The maximum allowed time (in seconds) for when there is no available connection in the STARTDT state (that is, no communication from the master station) before the application assumes communications have failed. Not used when set to 0.	0 to 86400	30
File Transfer Report Class	The report class to use when sending file transfer related PDU. Used in unbalanced mode only.	Class 1 Class 2	Class 2
<i>Balanced Serial Link Tab</i>			
Max ASDU Frame Length	The maximum length (in octets) of non-background messages (excluding framing overhead).	24 to 255	255
Extra Frame Timeout	The time (in milliseconds) that the application adds to the frame timeout calculation.	0 to 65535	150
Single Char Acknowledge	Specify if the application should respond to the master station with a single character acknowledgement message.	Enabled Disabled	Disabled
Transmit Retries	The maximum number of transmission retries when no acknowledgement is received from the master station before the application assumes communications has failed.	0 to 255	1
Extra Response Timeout	The time (in milliseconds) that the application adds to the frame timeout calculation.	0 to 65535	200
Inter Frame Gap	The minimum idle time (in milliseconds) between frames transmitted by the application.	0 to 1000	0
Holding Time	The maximum delay (in milliseconds) of reporting spontaneous data changes to the master station after the data is available for transmission.	0.1 to 500000.0	0.2
Retry Time	The interval (in seconds) between LRU attempts to resend messages held in its buffer after previous failed transmissions.	0.1 to 86400.0	5.0

## IEC 60870-5-101 Multi-drop

The following settings are used when configuring an IEC 60870-5-101 Multi-drop connection.

**Table 14 IEC 60870-5-101 Multi-drop**

Setting	Description	Range	Default
Link Address Size	The number of octets used for the link address of the device.	1 or 2	1
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>IEC 60870-5-101 Multi-drop Application Settings</i> .	Use Default Use Custom	Use Default
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
Common Address of ASDU	The device's common address of ASDU.	1 to 65534	1
Link Address	The link address of the device.	0 to 65535	1
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

### *IEC 60870-5-101 Multi-drop Application Settings*

IEC 60870-5-101 settings are available under the **Application Parameters** field.

**Table 15 IEC 60870-5-101 Multi-drop Application Parameters**

Setting	Description	Range	Default
<i>Application Tab</i>			
Number of Message Buffers	The number of message buffers allocated by the application used to receive messages and to transmit requests to the remote devices.	1 to 65535	5

Setting	Description	Range	Default
Restart Delay	The delay (in seconds) between each device restart sequence at application start-up.	0.0 to 3600.0	0.0
Stagger General Interrogation	Specifies whether or not GI polls performed by the application are staggered.	Enabled Disabled	Disabled
GI Qualifier	The Qualifier to use for the General Interrogation poll.	Global, Group 1 through Group 16	Global
GI Stagger Interval	The staggered GI poll interval (in minutes).	0.0 to 1440.0	30.0
Backoff Time	The time (in seconds) to wait before the application tries to re-contact a device after a communication failure.	0 to 65535	30
Min Inter Poll Delay	The minimum time delay (in minutes) between any two consecutive application level polls.	0.0 to 1440.0	0.0
Max ADSU Frame Length	The maximum value for the length (in octets) of non-background messages (excluding framing overhead).	24 to 255	255
Extra Frame Timeout	The time (in milliseconds) that the application adds to the frame timeout calculation.	0 to 65535	150
Max Confirm Idle Time	The maximum communication idle time (in milliseconds) before the application must receive a confirm message.	1 to 65535	100
Max Respond Idle Time	The maximum communication idle time (in milliseconds) before the application must receive a respond message.	1 to 65535	100
Max Transmit Retries	The maximum number of transmission retries before declaring that communication with a remote device has failed.	1 to 255	1
Wait Between Messages	The minimum time (in seconds) to wait between polls (measured from receiving the response of one poll to the beginning of the next poll).	0.0 to 60.0	0.0
Link Transmission Mode	The link transmission mode used by the application.	Unbalanced Balanced	Unbalanced
<i>Unbalanced Serial Link Tab</i>			
Background Polling Interval	The interval (in seconds) of background autonomous polling that happens at the data link layer.	0.0 to 86400.0	3.0

Setting	Description	Range	Default
Reply Poll Count	The Maximum number of times to poll a device for Class 2 and 1 data, subsequent to receiving a positive acknowledgement at the link layer (CONFIRM:ACK), in response to a "SEND/CONF user data" request at the link layer, that was sent due to an application level request.	0 to 255	10
Max Poll Count	The maximum number of times to poll a device for Class 1 data before changing to poll the next device, while performing background autonomous polling.	1 to 255	3
<i>Balanced Serial Link Tab</i>			
Extra Response Timeout	The time (in milliseconds) to add to the frame timeout calculation.	0 to 65535	200
Inter Frame Gap	The minimum idle time (in milliseconds) between frames transmitted by the application.	0 to 1000	0
Single Char Acknowledgement	Specifies if the application replies to the remote device with a single character acknowledgement.	Enabled Disabled	Disabled

### IEC 60870-5-103 Multidrop

The following settings are used when configuring an IEC 60870-5-103 Multi-drop connection.

**Table 16 IEC 60870-5-103 Multi-drop**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>IEC 60870-5-103 Multi-drop Application Settings</i> .	Use Default Use Custom	Use Default
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
Common Address of ASDU	The device's common address of ASDU.	0 to 254	1

Setting	Description	Range	Default
Link Address	The link address of the device.	0 to 254	1
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

*IEC 60870-5-103 Multi-drop Application Settings*

IEC 60870-5-103 settings are available under the **Application Parameters** field.

**Table 17 IEC 60870-5-103 Application Parameters**

Setting	Description	Range	Default
Number of Message Buffers	The number of message buffers allocated by the application used to receive messages and to transmit requests to the remote devices.	1 to 65535	5
TCP Pass Through Port	The TCP port number used by the application to listen for a pass through service connection from an IED vendor PC program. A port number of 0 disables the Pass Through connection service.	0 to 65535	0
Pass Through Wait Interval	The duration (in seconds) of silence on the serial interface before the application closes the pass through connection	1.00 to 300.00	120.0
Max Confirm Idle Time	The maximum communication idle time (in milliseconds) before the application must receive a confirm message.	1 to 65535	100
Max Respond Idle Time	The maximum communication idle time (in milliseconds) before the application must receive a respond message.	1 to 65535	100
Max Transmit Retries	The maximum number of transmission retries before declaring that communication with a remote device has failed.	1 to 255	1
Backoff Time	The time (in seconds) to wait before the application tries to re-contact a device after a communication failure.	0 to 65535	30
Background Polling Interval	The interval (in seconds) of background autonomous polling that happens at the data link layer.	0.0 to 86400.0	3.0
Wait Between Messages	The minimum time (in seconds) to wait between polls (measured from receiving the response of one poll to the beginning of the next poll).	0.0 to 60.0	0.0



Setting	Description	Range	Default
Quick Check	Specifies whether or not quick check is performed between standard polling for class data	Enabled Disabled	Enabled
Reply Poll Count	The Maximum number of times to poll a device for Class 2 and 1 data, subsequent to receiving a positive acknowledgement at the link layer (CONFIRM:ACK), in response to a "SEND/CONF user data" request at the link layer, that was sent due to an application level request.	0 to 255	10
Max Poll Count	The maximum number of times to poll a device for Class 1 data before changing to poll the next device, while performing background autonomous polling.	1 to 255	3
Reset Link Function Code	The function code for the reset link request	RESET_CU RESET_FCB	RESET_FCB

### LogicLinX Device

A LogicLinX Device connection is used to define a communications link between the LogicLinX application running on the D400 and a PC running the LogicLinX Editor.

This connection type can only be created using the *LogicLinX Wizard* in *ConfigPro CCE*. Once assigned, the connection is displayed to provide you with port details.

### Modbus Master Stations

The following settings are used when configuring a Modbus Master Station.

**Table 18 Modbus Master Station**

Setting	Description	Range	Default
Name	Text description to identify the master station being connected to.	1 to 32 ASCII characters	MASTERX
Master Station Address	DNP3 address of the server application instance.	0 to 65519	X
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>Modbus Server Application Settings</i> .	Use Default Create New...	Use Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

*Modbus Server Application Settings*

Modbus Server settings are available under the **Application Parameters** field.

**Table 19 Modbus Server Application Parameters**

Setting	Description	Range	Default
NACK Offline Digitals	If enabled, the D400 will NACK the offline coils upon receiving the <i>Force Single Coil</i> or <i>Force Multiple Coils</i> command with an Exception code 4 in the response. If disabled, the D400 reports the offline coil with the value OFF.	Yes No	No
NACK Offline Analogs	If enabled, the D400 will NACK the offline registers upon receiving the <i>Preset Single Register</i> or <i>Preset Multiple Register</i> command with an Exception code 4 in the response. If disabled, the D400 reports the value of the offline registers as 0.	Yes No	No

**Modbus Multi-drop**

The following settings are used when configuring a Modbus Multi-drop connection.

**Table 20 Modbus Multi-drop**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Protocol address of the device (i.e. DNP3 device address)	0 to 65519	X
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

**Printer Device**

The following settings are used when connecting a printer device. To print events, the Event Logger must be configured on the **System Wide** tab of the Configuration Tool.

Table 21 Printer Device

Setting	Description	Range	Default
Device Name	Text description to identify the printer connection.	1 to 32 ASCII characters	N/A
Auto Start-Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

### Redundancy Dedicated Link

The following settings are used when configuring D400 system redundancy. A Redundancy Dedicated Link is configured on the port that the D400 ping cable is connected to.

Table 22 Redundancy Dedicated Link

Setting	Description	Range	Default
Device Name	Text description to identify the redundancy connection.	1 to 32 ASCII characters	RLINKx

Ensure that both D400 units in the redundant setup have connected the ping cable to the same serial port number. In a redundant setup, the D400 Configuration Manager synchronizes configurations between the D400 units and this setting will be lost if there is a difference between the two.

### Redundancy Switch Panel

The following settings are used when configuring D400 system redundancy. A Redundancy Switch Panel connection is configured on the port that the RS232 watchdog cable is connected to.

Table 23 Redundancy Switch Panel

Setting	Description	Range	Default
Device Name	Text description to identify the redundancy connection.	1 to 32 ASCII characters	RSWITCHx

Ensure that both D400 units in the redundant setup have connected the watchdog cable to the same serial port number. In a redundant setup, the D400 Configuration Manager synchronizes configurations between the D400 units and this setting will be lost if there is a difference between the two.

### Single Generic ASCII

The Generic ASCII application is designed to extract data from devices using an ASCII-based communications protocol over a serial port. The information collected from these devices is stored in the internal system database of the D400.

Fault and Event Information is collected from connected devices, as well as Protective Relay Fault Information to facilitate user notification of faults.

The following settings are used when configuring a Single Generic ASCII connection.

**Table 24 Single Generic ASCII**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Protocol address of the device (i.e. DNP3 device address)	0 to 65519	X
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Password	For devices that require a password to access information.	1 to 32 ASCII characters	N/A

### Single SEL Binary

The Schweitzer Engineering Laboratories (SEL) Binary protocol supports exchanging information with SEL Fast Meter metering and relay devices over a serial link. It also supports pass through connection to the device.

#### *SEL Binary Client Application Parameters*

SEL Binary Client application settings are available under the **Application Parameters** field.

**Table 25 SEL Binary Client Application Parameters**

Setting	Description	Range	Default
Wait Between Messages	Duration, in seconds, to wait to transmit a new message after a response to the previous message has been received	0 to 60.00	0.1
Wait Between Cycles	Duration, in seconds, to wait to begin a new cycle of collecting data points after the previous one was complete	0 to 60.00	0
Response Timeout	Maximum duration, in seconds, to wait for a response from the device	0.100 to 300.00	1

Setting	Description	Range	Default
Communication Retries	Number of retries on the communications channel before the device is determined offline	0 to 100	2
Pass Through Wait Interval	Duration, in seconds, for which the device waits on the Serial Interface to obtain a response to a communication message received on the Pass Through socket	1.00 to 300.00	5
Demand Data Poll Cycle	How many times the Fast Meter Data must be retrieved before Demand Data can be polled. 0 disables Demand Data polling.	0 to 36000	600
Peak Demand Data Poll Cycle	How many times the Fast Meter Data must be retrieved before Peak Demand Data can be polled. 0 disables Peak Demand Data polling.	0 to 36000	600
History Poll Cycle	How many times the Fast Meter Data must be retrieved before the History command can be sent to the SEL device. 0 disables the History command.	0 to 36000	3600
Fault Reset Time	Time, in seconds, for which the fault parameter pseudo points retain values from the latest fault.	0 to 3600	5
Restrike Interval	Once the first fault has occurred, the time to wait (in seconds) before updating the Fault Pseudo points with information if subsequent faults occur before this interval has elapsed.	0 to 3600	30

The following settings are used when configuring a Single SEL Binary connection.

**Table 26 Single SEL Binary**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Protocol address of the device (i.e. DNP3 device address)	0 to 65519	X

Setting	Description	Range	Default
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled
Password	For devices that require a password to access information.	1 to 32 ASCII characters	N/A

### Terminal Server

The D400 can be configured to provide transparent access (also known as pass-through) to connected devices using vendor-supplied PC programs. This is done by configuring the port the device is connected to as a Terminal Server.

Refer to section 8.5 *Pass-Through Connections* for more information.

The following settings are used when configuring a Terminal Server.

Setting	Description	Range	Default
Device Name	Text description to identify the terminal server.	1 to 32 ASCII characters	N/A
Auto Start-Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

---

## 3.2 Network Connections

You can configure up to eight Ethernet ports for network communications using TCP/IP or UDP/IP to master stations and networked devices.

The D400 supports network connections as follows:

- Up to four instances of each client application
- Up to 64 devices per client instance
- Up to 8 master stations

The D400 currently supports network communications using the DNP3 protocol.

### Network Blocks

To improve the efficiency of communications, the D400 supports network capable device and master connections using “blocks” that can process communications concurrently. Each network block is an instance of a designated protocol (client or server application). Connections to devices are grouped on up to four data collection blocks per protocol.

#### *Network Devices*

Network capable devices can be connected to one or more data collection blocks and polled according to the instance-specific protocol settings.

### Network Master Stations

The D400 can support communications to multiple (up to eight) master stations. The data presented to each master station may be identical or unique as defined by a server map. Although the D400 accepts data requests from only one master station at a time, it can support requests from any master station.

### Adding a Network Connection

You manage the network connections on the D400 on the **Connection** tab on the **Configuration** page.

A map file must be available in the D400 before a protocol type can be added. The D400 includes several default maps. If you require a custom map, create it first before setting up the network connection. See section 4.2, *Client Maps* or section 5.2, *Server Maps*.

#### » To add a network connection

- On the **Configuration** page, click the **Connection** tab, then click **Add Connection** and configure each network connection.

Network devices are added to and configured in the defined network blocks. Each item under the **Network** heading of the **Connections** pane represents one device

connection through an Ethernet port on the D400. Up to 64 devices can be configured on each data collection block.

**Note:** IEC 61850 device connections are available for viewing only and cannot be edited on the Network page. To change the IEC 61850 client configuration, you must use the IEC 61850 Loader tool and re-load the configuration into the D400. Refer to the IEC 61850 Loader online Help for more information.

## Configuring Network Blocks

**Table 27 Network Block Connection Settings**

Setting	Description	Range	Default
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
IED Address	Address of the device.	0 to 65519	N/A
Map File	Name of the client map file to be used with the specific device.	List of user configured client map files.	N/A
IP Address	IP address of the device.	Single IP address	0.0.0.0
Backup IP Address	Redundant backup IP address of the device.	Single IP address	0.0.0.0
Network Port #	The port number on which the device will communicate.	0 to 65535	20000
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Enabled Disabled	Disabled

For instance-specific DNP3 Client application settings, see *DNP3 Client Application Settings* in section 3.1, *Serial Connections*. The communication settings in Table 10 are available on every instance of the client application.

## Configuring Network Master Stations

Each row under the **Network Master Stations** item represents one master connection through an Ethernet port on the D400. You can configure a maximum of 8 ports on the Master Block.

A server map file must be available in the D400, before a master type is available for selection on the **Master Connection** page. The D400 includes a default server map. If



you require a custom map, create it first before setting up the network connection. See section 5.2, *Server Maps*.

**Table 28 DNP3 Master Network Connection Settings**

Setting	Description	Range	Default
Remote Connection Name	Text description to identify the master station associated with this serial connection.	1 to 32 ASCII characters	N/A
Map File	Name of the Server map file to be used with the specific master.	List of user configured client map files.	N/A
Auto Start	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Automatic Disabled	N/A
D400 Address	DNP3 address of the server application instance.	0 to 65519	0
Transport Layer	Whether to use TCP or UDP network protocol.	TCP UDP	TCP
Network Port	The D400 port number on which the master station will communicate.	0 to 65535	20001
Permitted Remote Hosts	IP addresses of master stations permitted to connect to the D400. If all are set to 0.0.0.0, all hosts will be able to connect.	Up to 8 IP addresses	0.0.0.0

### *Application Parameters*

For instance-specific DNP3 Server application settings, see *DNP3 Server Application Parameters* in section 3.1, *Serial Connections*. The communication settings in Table 7 and Table 8 are available on every instance of the server application.

For instance-specific Modbus Server application settings, see *Modbus Server Application Settings* in section 3.1, *Serial Connections*. The communication settings in Table 19 are available on every instance of the server application.

For instance-specific IEC 60870-5-101 Server application settings, see *IEC 60870-5-101 Master Station Application Settings* in section 3.1, *Serial Connections*. The communication settings in Table 13 are available on every instance of the server application.

### **IEC 60870-5-104 IED Block**

The following settings are used when configuring an IEC 60870-5-104 IED block.

**Table 29 IEC 60870-5-104 IED Block**

Setting	Description	Range	Default
Auto Start Up	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Disabled Enabled	Disabled

Setting	Description	Range	Default
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>IEC 60870-5-104 IED Block Application Settings</i> .	Use Default Use Custom	Use Default
Line ID	Text description to identify the electrical transmission line associated with this serial connection.	1 to 32 ASCII characters	Line X
Device ID	Text description to identify the device associated with this serial connection.	1 to 32 ASCII characters	Device X
Bay ID	Text description to identify the bay area associated with this serial connection.	1 to 32 ASCII characters	Bay X
Common Address of ASDU	The device's common address of ASDU.	0 to 254	1
Map File	Name of the Client map file to be used with the specific device.	List of user configured client map files.	N/A
IP Address	IP address of the device.	Single IP address	0.0.0.0
Backup IP Address	Redundant backup IP address of the device.	Single IP address	Blank
Network Port #	The port number on which the device will communicate.	0 to 65535	2404
Transport Layer	Whether to use TCP or UDP network protocol.	Non editable	TCP
Enable on Start Up	Indicates if communication to the device automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Enabled Disabled	Disabled

### *IEC 60870-5-104 IED Block Application Settings*

IEC 60870-5-104 settings are available under the **Application Parameters** field.

**Table 30 IEC 60870-5-104 IED Block Application Parameters**

Setting	Description	Range	Default
<i>Application Tab</i>			
Number of Message Buffers	The number of message buffers allocated by the application used to receive messages and to transmit requests to the remote devices.	1 to 65535	5
Device Restart Delay	The delay (in seconds) between each device restart sequence at application start-up.	0.0 to 3600.0	0.0
Stagger General Interrogation	Specifies whether or not GI polls performed by the application are staggered.	Enabled Disabled	Disabled

Setting	Description	Range	Default
GI Qualifier	The Qualifier to use for the General Interrogation poll.	Not editable	Blank
GI Stagger Interval	The staggered GI poll interval (in minutes).	Not editable	Blank
Backoff Time	The time (in seconds) to wait before the application tries to re-contact a device after a communication failure.	0 to 65535	30
Min Inter Poll Delay	The minimum time delay (in minutes) between any two consecutive application level polls.	0.0 to 1440.0	0.0
<i>Network Tab</i>			
Max Length APDU Frame	The maximum length (in octets) of APDU frames.	253	Not editable

### IEC 60870-5-104 Master Station

The following settings are used when configuring an IEC 60870-5-104 Master Station connection.

**Table 31 IEC 60870-5-104 Master Station**

Setting	Description	Range	Default
Remote Connection Name	Text description to identify the master station associated with this serial connection.	1 to 32 ASCII characters	N/A
Map File	Name of the Server map file to be used with the specific master.	List of user configured client map files.	N/A
Auto Start	Indicates if the client application automatically starts when the configuration is changed and reloaded or when the D400 re-boots.	Automatic Disabled	Disabled
Common Address of ASDU	The device's common address of ASDU.	1 to 65534	1
Transport Layer	Whether to use TCP or UDP network protocol.	Non editable	TCP
Network Port	The D400 port number on which the master station will communicate.	0 to 65535	2404
Application Parameters	Select the application parameters defining this connection. The default parameters can be used, or a custom configuration can be created. Refer to <i>IEC 60870-5-104 Master Station Application Settings</i> .	Use Default Use Custom	Use Default
Accept All Hosts	If enabled, all remote hosts are able to connect.	Enabled Disabled	Disabled

Setting	Description	Range	Default
Permitted Remote Hosts	IP addresses of master stations permitted to connect to the D400. If <i>Accept All Hosts</i> is enabled, these fields are disabled and ignored.	Up to 8 IP addresses	0.0.0.0

### IEC 60870-5-104 Master Station Application Settings

IEC 60870-5-104 settings are available under the **Application Parameters** field for Master Stations.

**Table 32 IEC 60870-5-104 Master Station Application Parameters**

Setting	Description	Range	Default
<i>Application Tab</i>			
Time Mode	Specifies if the master station is allowed to set or use the main D400 and/or local LRU time.	Set main/use main time Set local/use local time Set local/use main time	Set main/use main time
Time Sync Timeout	The maximum allowed time (in seconds) between time synchronization attempts from the IEC 60870-5-101/104 master station or other time source before time tagged data is reported as invalid by the LRU. Not used when set to 0.	0 to 86400	900
Control Select Timeout	The maximum allowed time (in seconds) between control select and control execute commands (for digital and analog output points) from the IEC 60870-5-101/104 master station.	0.01 to 60.0	5.0
Double Point Valid Time	The minimum time (in seconds) that both digital input points must be stable before an ON/OFF state is reported. Note: The value of this property only applies when the corresponding parameters of a double point information object are specified as undefined. Not used when set to 0.	0 to 65535	500
Double Point Suppress Time	The minimum time (in seconds) that both digital input points must be stable before an indeterminate state is reported. Note: The value of this property only applies when the corresponding parameters of a double point information object are specified as undefined. Not used when set to 0.	0 to 65535	1000

Setting	Description	Range	Default
LRU Event Buffer Size	The number of events (non-time-tagged, time-tagged, and hour update objects) that are buffered by this LRU.	50 to 65535	255
LRU Event Buffer Location	The location where unreported events that are collected from event queues are stored.	RAM NVRAM	RAM
Event Buffer Overflow Policy	Specify whether the newest or oldest events are discarded when the server event buffer is filled.	Discard Newest Discard Oldest	Discard Newest
Event Buffer Low Threshold	A percent value of the total event buffer. When the amount of available buffer space drops below this threshold, a server event buffer low indication is reported by the application.	10 to 100	20
DI Cancels Select	Specify whether digital output select requests are automatically cancelled when any digital input changes are detected.	Enabled Disabled	Disabled
Buffer AI	Specify whether analog input changes (spontaneous, periodic, background scan) are buffered for reporting. When this is enabled, the LRU reports each analog change separately.  For example, if an analog input point exceeds the threshold 3 times before the LRU is polled for data in unbalanced mode, the LRU shall report all 3 value changes. If this feature is disabled, the LRU shall report only the most recent value.	Enabled Disabled	Disabled
Zero Threshold Reporting	Specify how the LRU should treat a zero value for the Threshold configuration parameter for an analog input.  If this setting is enabled, setting the threshold configuration parameter of an analog input point to zero (i.e. 0.0) spontaneously reports all changes for the point. If disabled, setting the Threshold configuration parameter of an analog input point to zero shall disable spontaneous reporting for the point.	Enabled Disabled	Disabled
Time Tagging	When to report time-tag data.  If configured as <i>Not on Interrogations</i> , the LRU reports a time tag only for spontaneous, periodic/cyclic, or background scan causes of transmission (that is, the LRU suppresses time tag for interrogated data). If configured as <i>Always</i> , the LRU reports time tag for all causes of transmission.	Not on Interrogations Always	Not on Interrogations
Clear Statistics	Specify if the application should reset all LRU statistics to zero at startup.	Enabled Disabled	Disabled

Setting	Description	Range	Default
Comm Log Mode	The logging mode for all I/O communications traffic with the LRU.	Disabled ASCII Hex ASCII and Hex	Hex
Number of Files Supported	The number of information object addresses reserved for file transfer. Not used when set to 0.	0 to 128	0
Time to Live	The time period (in seconds) a queued control command is to be treated as active in the system. If the configured value is 0, the RTBD setting is used.	0.0 to 60.0	0.0
Holding Time	The maximum delay (in milliseconds) of reporting spontaneous data changes to the master station after the data is available for transmission.	0.1 to 500000.0	0.2
Control Time Window	The time range (in seconds) used to qualify a time-tagged request.	0.001 to 86400.0	1
<i>Network Tab</i>			
Comm Fail Timeout	The maximum allowed time (in seconds) for when there is no available connection in the STARTDT state (that is, no communication from the master station) before the application assumes communications have failed. Not used when set to 0.	0 to 86400	30
Max TX Frames Before Ack	The maximum number of information frames that the application transmits before it must receive an acknowledgement message (value of <b>w</b> ).	1 to 32,767	8
Max RX Frames Before Ack	The maximum number of information frames that the application receives before it must send an acknowledgement message (value of <b>k</b> ).	1 to 32,767	12
Connect Timeout	The maximum time (in seconds) that the application waits for the TCP transport layer to establish a connection (value of <b>t0</b> ).	1 to 255	30
Send Timeout	The maximum time (in seconds) that the application waits for an acknowledgement after sending a frame (value of <b>t1</b> ).	1 to 255	15
No Data Timeout	The maximum time (in seconds) that the application waits before sending a supervisory acknowledgement (S) frame (value of <b>t2</b> ).	1 to 255	10

Setting	Description	Range	Default
Idle Timeout	The period during which no messages are received, in seconds, that the application allows pass before sending a test frame (value of <b>t3</b> ).	1 to 255	20
Max APDU Frame Length	The maximum length (in octets) of APDU frames.	253	Not editable

# 4

## Configuring Devices

You can customize the D400 to poll, receive and store the necessary data from connected Intelligent Electronic Devices (IEDs). Client applications in the D400 allow the D400 to collect event and/or static data from devices through different communication protocols and store the data in the system point database.

The D400 configuration tool supports configuration of protocol-specific object references, scaling factors, and user-defined names for various objects configured for collection. Where applicable, you can also configure additional device-level settings (for the same protocol) at the same time.

This chapter gives detailed information for configuring specific types of devices. For step-by-step information on using the configuration tool, refer to the D400 online Help.

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### 4.1 Configuration Overview

Configuring the D400 to communicate with devices typically includes the following steps:

1. Create D400 client map file for each device and protocol type.
2. Define the data points list and set point properties.
3. Set protocol-specific properties.
4. Set up serial and network device connections.
5. Configure protocol-specific settings for each device connection.
6. Save the configuration file.
7. Run the configuration file in the D400 by committing the changes.



## 4.2 Client Maps

The D400 communicates with devices connected to your power network. These devices monitor and record several types of information. The information can be generally classified in the following point groups, defined by default in the D400:

- Present values (PVal) that reflect the current state of the power system at an instance in time.
- Peak demand that reflects the minimum and maximum power flow conditions encountered.
- Demand

Point groups can be modified on the **System Wide** tab in the D400 Online Configuration Tool.

The devices store all the information in a “map”. Refer to the device manufacturer’s manual for a list and description of all the data points available from a particular device.

The D400 polls for and retrieves information from a device according to a client map file. The client map file is based on a specific protocol and specifies what information to gather from a device. The map file contains information on how polling is scheduled for a particular type of device based on the device’s capabilities, frequency of polling, selected data points, etc.

The D400 includes the following default client maps:

- DNP3
- Hydran
- SEL Binary
- MODBUS

You can use these default client maps or customize them for your system requirements. Once you create a client map file, it becomes available to select on the Configuration page when assigning device connections.

**Note:** If you are running a LogicLinx program on your D400 and you change the point mapping, you must synchronize the configuration within ConfigPro CCE to ensure that your LogicLinx mappings are still valid.

### Creating Client Maps

#### » To create or edit a client map

1. On the **Configuration** page, select the **Client Map** tab.
2. Click **New** to create a new client map or **Open** to edit an existing client map.
3. Select the device protocol type and then create or select the device map file.
4. Edit the data type and device protocol settings as desired.
5. Click **Save** and enter a name for your map file.

**Tip** Keep the default map files as basic templates. To create custom templates, modify the default map files, click "Save" and then enter a new template name.

For more information on creating a client map, refer to the D400 online Help.

### 4.3 IEC 60870-5-101+104

The IEC 60870-5-101+104 Client map defines how the D400 is configured to poll data from IEC 60870-5-101+104 compliant devices. Map settings are available on the **Client Map** tab when an IEC 60870-5-101+104 protocol type is selected.

#### Common Properties

Settings are available in the **Device Properties** pane. Table 33 lists the device-specific protocol settings.

**Table 33 Common Properties**

Setting	Description	Range	Default
Buffer Overflow DI	The information object address of the DI point where the ON (1) state indicates that the event buffer on the device has overflowed. A value of 0 disables this feature.	0 to 16777215	0
Command Timeout	The time (in seconds) after which a Command is assumed to have completed if the Termination message has not been received from the remote device.	0.01 to 3600.0	10.0
General Interrogation Timeout	The time (in seconds) after which a General Interrogation is assumed to have completed if no Termination of General Interrogation message has been received from the remote device.	0.01 to 3600.0	30.0
Counter Interrogation Timeout	The time (in seconds) after which a Counter Interrogation is assumed to have completed if no Termination of Counter Interrogation message has been received from the remote device.	0.01 to 3600.0	30.0
Time Sync Timeout	The time (in seconds) after which a Delay Acquisition Request or a Time Sync request is assumed to have completed if the ACTCON PDU has not been received from the remote device.	0.01 to 3600.0	5.0
ACTCON Expected	Specifies whether or not an ACTCON PDU is expected from the remote device after the application sends an ACT PDU request.	Yes No	Yes

Setting	Description	Range	Default
ACTCON Timeout	The time (in milliseconds) after which an ACTCON PDU is assumed to come back after sending out a request of ACT PDU (only applicable to control requests, general interrogation requests, and counter interrogation requests).	1 to 65535	1000
ACTTERM Expected	Specifies whether or not an ACTTERM PDU is expected to indicate the completion of a transaction.	Yes No	Yes
Time Offset	The device's time base offset from UTC, in minutes. A positive value means the device's time base is ahead (or East) of GMT while a negative value means the device's time base is behind (or West) of GMT.	-1440 to 1440	0
Control Override	Specifies whether or not the application shall override the Control Type sent in an RTDB control request, to use in the actual Binary Output request to the remote device.	None DirectOperate SBO	None
Time Sync Interval	The time synchronization interval (in minutes). A value of 0.0 disables scheduled time synchronization to the remote device.	0.0 to 1440.0	10.0
Global Counter Interrogation Interval	The Global Counter Interrogation interval (in minutes). A value of 0.0 disables Global Counter Interrogations to the remote device, except on application startup.	0.0 to 1440.0	0.0
Group X Counter Interrogation Interval	The Group X Counter Interrogation interval (in minutes). A value of 0.0 disables Group X Counter Interrogations to the remote device, except on application startup.	0.0 to 1440.0	0.0
Global Interrogation Interval	The Global General Interrogation Interval (in minutes). A value of 0.0 disables Global General Interrogations to the device, except on application startup.	0.0 to 1440.0	30.0
Group X Interrogation Interval	The Group X General Interrogation Interval (in minutes). A value of 0.0 disables Group X General Interrogations to the device, except on application startup.	0.0 to 1440.0	0.0

**IEC 60870-5-101**

Settings are available in the **IEC 60870-5-101** pane. Table 34 lists the device-specific protocol settings.

**Table 34 IEC 60870-5-101 Properties**

Setting	Description	Range	Default
Information Object Address Length	The number of octets used in the information object address field.	1 to 3	1
Cause of Transmission Length	The number of octets used in the Cause of Transmission field.	1 to 2	1
Data Link Confirm	Specifies whether or not the application requests data link confirmation when transmitting data	Enabled Disabled	Enabled
TX Delay Acquisition	Specifies whether or not the application performs a TX Delay Acquisition command to the device prior to performing the Clock Synchronization	Enabled Disabled	Enabled
Default TX Delay	The default transmission delay (in milliseconds) that is used by the application to perform a Clock Sync of the remote device when the TX Delay Acquisition is disabled	0 to 60000	0

**IEC 60870-5-104**

Settings are available in the **IEC 60870-5-104** pane. Table 35 lists the device-specific protocol settings.

**Table 35 IEC 60870-5-104 Properties**

Setting	Description	Range	Default
Information Object Address Length	The number of octets used in the information object address field.	Not editable	3
Cause of Transmission Length	The number of octets used in the Cause of Transmission field.	Not editable	2
Default TX Delay	The transmission delay (in milliseconds) that is used by the application to perform a Clock Sync of the remote device.	0 to 60000	0
Controls with Time Tag	Specify if the application is to include a time tag with control requests.	Enabled Disabled	Disabled
Max TX Frames Before Ack	The maximum number of information frames that the application transmits before it must receive an acknowledgement message (value of <b>w</b> ).	1 to 32,767	8
Max RX Frames Before Ack	The maximum number of information frames that the application receives before it must send an acknowledgement message (value of <b>k</b> ).	1 to 32,767	12
Connect Timeout	The maximum time (in seconds) that the application waits for the TCP transport layer to establish a connection (value of <b>t0</b> ).	1 to 255	30
Send Timeout	The maximum time (in seconds) that the application waits for an acknowledgement after sending a frame (value of <b>t1</b> ).	1 to 255	15
No Data Timeout	The maximum time (in seconds) that the application waits before sending a supervisory acknowledgement (S) frame (value of <b>t2</b> ).	1 to 255	10
Idle Timeout	The period during which no messages are received, in seconds, that the application allows pass before sending a test frame (value of <b>t3</b> ).	1 to 255	20

## Info Objects

An information object consists of a set of data elements. You can create the following types of information objects:

- Input
  - Bitstring
  - Double Point
  - Integrated Total
  - Measurand
  - Packed Single Point
  - Single Point
  - Step Position
- Output
  - Double Command
  - Regulating Step Command
  - Setpoint Command
  - Single Command

### » To create an Information Object

1. Click **Add Info Object**.
2. On the **New Info Object** window, enter values for the fields as described in Table 36 and click **OK**.
3. Enter the number of rows and click **Add** to create and configure elements within the information object.

**Table 36 Info Object Settings**

Setting	Description	Range
Info Object Type	The type of information object to create.	Bitstring Double Point Integrated Total Measurand Packed Single Point Single Point Step Position Double Command Regulating Step Command Setpoint Command Single Command
Info Object Name	An identifier used within the configuration interface.	1 to 128 ASCII characters
Address	The assigned address for BitString and Packed Single Point types; the starting default address for all other types.	1 to 16777215

The table directly below the Info Object type drop-down menu shows the configured Info Object Name and either the Address or Starting Address of the selected information object. When Bitstring or Packed Single Point types are selected, the Address value indicates the actual information object address. If any other Info Object type is selected, the Starting Address value indicates the default starting address that will be used when a new information object element is added.

The Info Object Name field in this table cannot be edited.

#### *Bitstring*

**Table 37 Bitstring Element Settings**

Setting	Description	Range	Default
Bit Position	The bit position within the DI point	1 to 32	Incremented from 1
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

#### *Double Command*

**Table 38 Double Command Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	DC X
Command Qualifier	An attribute that specifies in greater detail the type of control action requested.	No Additional Definition Short Pulse Duration Long Pulse Duration Persistent	Persistent
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF

Setting	Description	Range	Default
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Double Point*

**Table 39 Double Point Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
P1 Name	Text description of the first point in the map file for this double point object.	Up to 128 characters	DP XA
P1 ON State	Text description of the 1 state for the first point.	Up to 32 characters	ON
P1 OFF State	Text description of the 0 state for the first point.	Up to 32 characters	OFF
P1 Group	Point group to which the first point belongs.	List of defined point groups	Group assigned to ID number 0
P2 Name	Text description of the second point in the map file for this double point object.	Up to 128 characters	DP XB
P2 ON State	Text description of the 1 state for the second point.	Up to 32 characters	ON
P2 OFF State	Text description of the 0 state for the second point.	Up to 32 characters	OFF
P2 Group	Point group to which the second point belongs.	List of defined point groups	Group assigned to ID number 0

*Integrated Total*

**Table 40 Integrated Total Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	IT X
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0



*Measurand***Table 41 Measurand Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	M X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Packed Single Point***Table 42 Packed Single Point Element Settings**

Setting	Description	Range	Default
Bit Position	The bit position within the DI point	1 to 32	Incremented from 1
Point Name	Text description of the point in the map file.	Up to 128 characters	<object name> X
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Regulating Step Command***Table 43 Regulating Step Command Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	RC X

Setting	Description	Range	Default
Regulating Command State	The relative position that the step controller is commanded to move to.	Lower Higher	Lower
Command Qualifier	An attribute that specifies in greater detail the type of control action requested.	No Additional Definition Short Pulse Duration Long Pulse Duration Persistent	Persistent
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Setpoint Command***Table 44 Setpoint Command Type 2 Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	SC X
Conversion	The type of setpoint command. There are 3 possible types: <ul style="list-style-type: none"> <li>Normalized - value is between -1 and +1 -2<sup>-15</sup></li> <li>Scaled - value is scaled using multiplier and offset to -2<sup>15</sup> to +2<sup>15</sup> - 1</li> <li>Short Floating Point - value is a 32-bit floating point.</li> </ul>	Normalized Scaled ShortFP	Normalized
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Single Command***Table 45 Single Command Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	SC X
Command Qualifier	An attribute that specifies in greater detail the type of control action requested.	No Additional Definition Short Pulse Duration Long Pulse Duration Persistent	Persistent
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Single Point***Table 46 Single Point Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	SP X
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Step Position***Table 47 Step Position Element Settings**

Setting	Description	Range	Default
Address	The address of this information object element	1 to 16777215	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	SP X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

#### 4.4 IEC 60870-5-103

The IEC 60870-5-103 Client map defines how the D400 is configured to poll data from IEC 60870-5-103 compliant devices. Map settings are available on the **Client Map** tab when an IEC 60870-5-103 protocol type is selected.

##### Device Properties

Settings are available in the **Device Properties** pane. Table 48 lists the device-specific protocol settings.

**Table 48 IEC 60870-5-103 Device Properties**

Setting	Description	Range	Default
Time Offset	The device's time base offset from UTC, in minutes. A positive value means the device's time base is ahead (or East) of GMT while a negative value means the device's time base is behind (or West) of GMT.	-1440 to 1440	0
Data Link Confirm	Specifies whether or not the application will request data link confirmation when transmitting data.	Enabled Disabled	Enabled
General Interrogation Interval	The General Interrogation interval (in minutes). A value of 0.0 disables General Interrogations to the remote device, except on application startup.	0.0 to 1440.0	30.0

Setting	Description	Range	Default
General Interrogation Timeout	The time (in seconds) after which a General Interrogation is assumed to have completed if no Termination of General Interrogation message has been received from the remote device.	0.01 to 3600.0	30.0
Command Timeout	The time (in seconds) after which a General Command is assumed to have completed if the appropriate ASDU Type 6 (COT=ACK or NACK) message has not been received from the remote device.	0.01 to 3600.0	10.0
Auto Time Sync	Specifies whether or not the application performs a time sync to the remote device when the application detects a change in the local system time and at application startup.	Enabled Disabled	Enabled
Time Sync Interval	The time synchronization interval (in minutes). A value of 0.0 disables scheduled Time Synchronizations to the remote device.	0.0 to 1440.0	10.0
Time Sync Timeout	The time (in seconds) after which a time sync shall be assumed to have completed if the appropriate ASDU Type 6 (COT=Time Sync) message has not been received from the remote device.	0.01 to 3600.0	5.0

## Info Objects

An information object consists of a set of data elements. You can create the following types of information objects:

- Input
  - Measurand Time Tag Relative
  - Measurand Type 1
  - Measurand Type 2
  - Measurand User Defined
  - Time Tagged Message
- Output
  - General Command

## >> To create an Information Object

1. Click **Add Info Object**.
2. On the **New Info Object** window, enter values for the fields as described in Table 49 and click **OK**.
3. Enter the number of rows and click **Add** to create and configure elements within the information object.

**Table 49 Info Object Settings**

Setting	Description	Range
Info Object Type	The type of information object to create.	General Command Measurand Time Tag Relative Measurand Type 1 Measurand Type 2 Measurand User Defined Time Tagged Message
Info Object Name	An identifier used within the configuration interface.	1 to 128 ASCII characters
Function Type	The IEC 60870-5-103 function type corresponding to this information object type reported by the remote device.	0 to 255
Info Number	Starting address for this object.	0 to 255

The table directly below the Info Object type drop-down menu shows the configured Info Object Name and either the Function Type and Info Number or the Default Function Type and Initial Info Number of the selected information object.

When General Command or Time Tagged Message types are selected, the Default Function Type value indicates the default function type that will be used when a new information object element is added. The Initial Info Number value is incremented for each new information object element that is added.

**Note:** Additional info-object level settings are available for *Time Tagged Message* objects. These are described in Table 55 below.

For all other info object types, values entered for Function Type and Info Number are used for all information object elements that are created.

#### *General Command*

**Table 50 General Command Element Settings**

Setting	Description	Range	Default
Function Type	The IEC 60870-5-103 function type corresponding to this information object type reported by the remote device.	0 to 255	0
Info Number	Address for this object.	0 to 255	Incremented by 1 from starting address
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X/Y
ON State	Text description of the 1 state.	Up to 32 characters	ON

Setting	Description	Range	Default
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Measurand Time Tag Relative Time*

**Table 51 Measurand Time Tag Relative Time Element Settings**

Setting	Description	Range	Default
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Measurand Type 1*

**Table 52 Measurand Type 1 Element Settings**

Setting	Description	Range	Default
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	0.0
Element Name	Specifies the name of each element.	current L2 or I.N, voltage L1-L2 or V.EN, active power P, reactive power Q	current L2 or I.N
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Measurand Type 2***Table 53 Measurand Type 2 Element Settings**

Setting	Description	Range	Default
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	0.0
Element Name	Specifies the name of each element.	current L1 current L2 current L3 voltage L1-E voltage L2-E voltage L3-E active power P reactive power Q frequency f	current L1
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

*Measurand User Defined***Table 54 Measurand User Defined Element Settings**

Setting	Description	Range	Default
Measurand Position	You can define up to 255 elements within the Measurand User Defined info object type. The Measurand Position setting specifies the element position that this value is assigned to.	1 to 255	Incremented from 1
Point Name	Text description of the point in the map file.	Up to 128 characters	<Info object name> X
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx +b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0



*Time Tagged Message***Table 55 Time Tagged Message Info Object Settings**

Setting	Description	Range	Default
Relative Time	Specifies whether the time tagged message is returned using relative times.	Yes No	No
In General Interrogation	Specifies whether the points in this object are returned in response to a General Interrogation.	In General Interrogation Not In General Interrogation	In General Interrogation
Fleeting Points	Specifies whether the points in this object are fleeting points.	Fleeting Points Not Fleeting Points	Fleeting Points
Fleeting Points Reporting	Specifies how fleeting point values are sent to the database. Applicable only for fleeting point objects.	Two Events Send Always	Two Events

**Table 56 Time Tagged Message Element Settings**

Setting	Description	Range	Default
Function Type	The IEC 60870-5-103 function type corresponding to this information object type reported by the remote device.	0 to 255	0
Info Number	Starting address for this object.	0 to 255	Incremented by 1 from starting address
P1 Name	Text description of the first point in the map file for this double point object.	Up to 128 characters	See note
P1 Group	Point group to which the first point belongs.	List of defined point groups	Group assigned to ID number 0
P1 ON State	Text description of the 1 state for the first point.	Up to 32 characters	ON
P1 OFF State	Text description of the 0 state for the first point.	Up to 32 characters	OFF
P2 Name	Text description of the second point in the map file for this double point object.	Up to 128 characters	See note
P2 Group	Point group to which the second point belongs.	List of defined point groups	Group assigned to ID number 0
P2 ON State	Text description of the 1 state for the second point.	Up to 32 characters	ON
P2 OFF State	Text description of the 0 state for the second point.	Up to 32 characters	OFF

**Note:** The format for the default value is **X/Y Z**, where X is the function type, Y is the info number, and Z is either *Point 1* or *Point 2*.

## 4.5 DNP3 Client

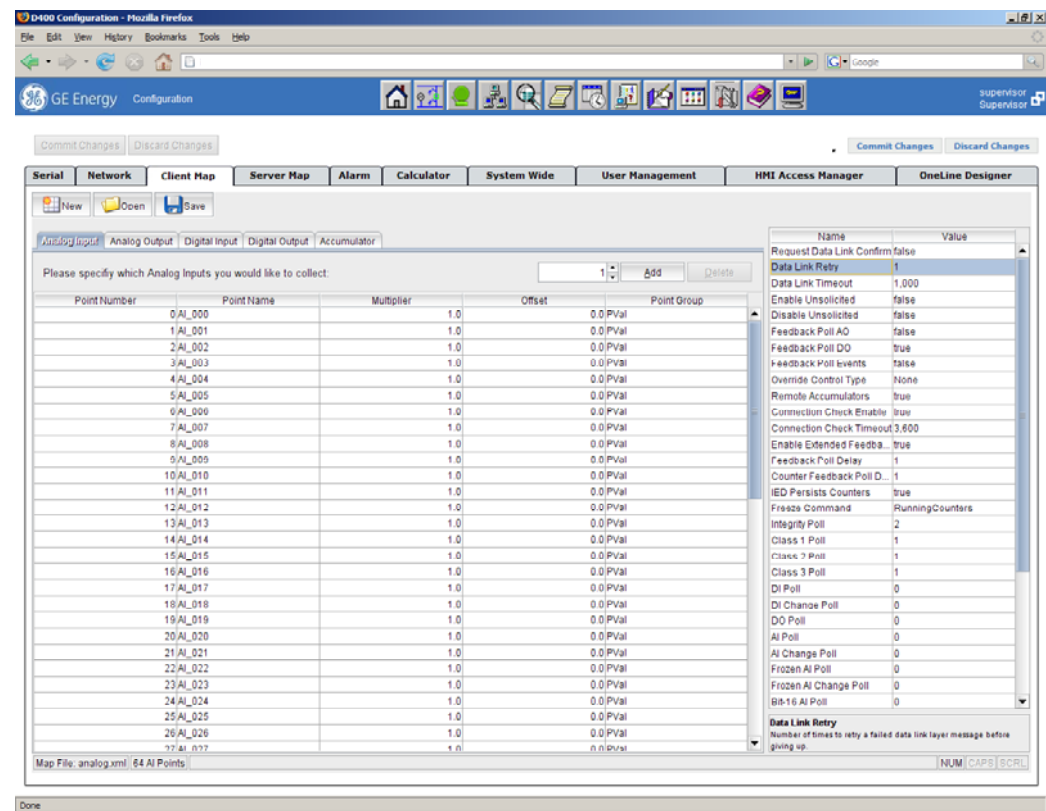
The DNP3 Client map defines how the D400 is configured to poll data from DNP3 devices. The D400 supports the following configurable DNP3 data types:

- Analog inputs - measured or computed values by the device
- Analog outputs - physical or computed analog quantities
- Digital inputs - states of physical or logical Boolean devices
- Digital outputs - physical or logical ON-OFF, raise-lower, and trip-close points
- Accumulators - counter values
- Device properties – device-level settings

The DNP3 Client map settings are available on the **Client Map** tab when a DNP3 protocol device type is selected.

**Note:** Additional DNP3 client configuration settings are available for device communications when configuring DNP3 serial connections on the **Serial** tab.

Figure 7 DNP3 Client Map Page



## Analog Inputs

Settings are available on the **Analog Input** tab on the **Client Map** tab. The D400 provides the mapping settings for analog inputs as shown in Table 57.

**Table 57 Analog Input Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the device Analog Input Map.	0 to 65535	Incremented from 0
Point Name	Text description of the point in the Analog Input Map.	Up to 128 characters	DI xxx
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

## Analog Outputs

Settings are available on the **Analog Output** tab on the **Client Map** tab. The D400 provides the mapping settings for analog outputs as shown in Table 58.

**Table 58 Analog Output Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the Analog Output Map.	0 to 65535	Incremented from 0
Point Name	A text string that describes this point.	Up to 128 characters	AO_XXX
Multiplier	Scale Factor of a point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale Factor of a point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0
AO Variation	How the point values should be reported.	16-bit, 32-bit	16-bit

## Digital Inputs

Settings are available on the **Digital Input** tab on the **Client Map** tab. The D400 provides the mapping settings for digital inputs as shown in Table 59.

**Table 59 Digital Input Mapping Settings**

Setting	Description	Range	Default
Point #	The DNP3 Point Index of this point as reported from the device.	0 to 65535	Incremented from 0
Point Name	A text string that describes this point.	Up to 128 characters	DI xxx
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### Digital Outputs

Settings are available on the **Digital Output** tab on the **Client Map** tab. The D400 provides the mapping settings for digital outputs as shown in Table 60.

**Table 60 Digital Output Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the Digital Output Map.	0 to 65535	Incremented
Point Name	A text string that describes this point.	Up to 128 characters	DO xxx
ON State Name	Text description of the 1 state.	Up to 32 characters	OFF
OFF State Name	Text description of the 0 state.	Up to 32 characters	ON
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### Accumulators

Settings are available on the **Accumulators** tab on the **Client Map** tab. The D400 provides the mapping settings for accumulators as shown in Table 61.

**Table 61 Accumulator Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the Accumulator Map.	0 to 65535	Incremented from 0
Point Name	A text string that describes this point.	Up to 128 characters	ACC_xxx
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

## Device Properties

Settings are available in the **Device Properties** pane on the **Client Map** tab. Table 62 lists the poll-specific settings for the DNP3 device.

**Table 62 DNP3 Device Properties**

Setting	Description	Range	Default
Name	Name of the device map file.	Up to 8 characters	N/A
Request Data Link Confirm	Enables request Data Link Confirmations from the device.	True False	True
Data Link Retry	How many times to retry a failed data link layer message before giving up. Increase the value for unreliable connections, noisy environment, modem communication, etc.	0 to 300	1
Data Link Timeout	Time (in milliseconds) to wait for a data link layer response before deciding it has failed. Set the value much higher for a modem connection, i.e. 600000.	1 to 3600000	1000 (i.e. 1 second)
Enable Unsolicited	True: Send Enable Unsolicited at startup, and in response to a NULL UR. False: Never send Enable Unsolicited.	True False	False
Disable Unsolicited	True: Send Disable Unsolicited at startup, and in response to ANY UR. False: Never send Disable Unsolicited.	True False	False
Feedback Poll AO	When the LOCAL IIN bit is asserted in the device, poll for Analog Outputs.	True False	False
Feedback Poll DO	When the LOCAL IIN bit is asserted in the device, poll for Digital Outputs.	True False	True
Feedback Poll Events	When the LOCAL IIN bit is asserted in the device, poll for Class 1, 2, 3 data.	True False	False
Override Control Type	When an Override is configured, ignore the Control Type propagated by the system point database. That is, always send the control type configured for this setting.	None Direct Operate Direct Operate No ACK SBO	None
Remote Accumulators	True: Send Accumulator commands to the device. False: Perform accumulator operations in the system point database.	True False	True
Link Check Enable	True: Periodically send Link Status messages to the device to check connection.	True False	True

Setting	Description	Range	Default
Link Check Timeout	If Connection Check is enabled, send a Link Status message to the device after this time out interval (in seconds) has elapsed since a message was last received from the device	30 to 36000	3600
Enable Extended Feedback Polling	True: Send the Extended Digital/Analog Feedback poll to the device when a Digital/Analog control is sent to the device.	True False	True
Feedback Poll Delay	Interval to wait (in seconds) after the control is requested, before issuing the Feedback Poll.	1 to 3600	1
Counter Feedback Poll Delay	Interval to wait (in seconds) after the counter command is requested before issuing the counter poll.	1 to 3600	1
IED Persists Counters	True: Device persists counters across restarts. False: Device clears counters on startup. This setting affects accumulator processing.	True False	True
Freeze Command Type	Freeze command used by the application: Freeze (and Clear) Running Counters or Freeze (and Clear) Frozen Counters.	Running Counters Frozen Counters	Running Counters
Time Offset	Time offset (in minutes) from UTC. For example, for Eastern Standard Time, specify -300, which means UTC minus 5 hours. Specify only if the device does not use UTC within DNP3 messages. DNP3 requires the time base to be UTC, but non-compliant devices may use local time.	-1440 to 1440	0
Integrity Poll (min)	The D400 requests integrity poll data at this interval (in minutes). If set to 0, the request is never transmitted.	1 to 6000	5
Class1 Poll (sec)	The D400 requests class 1 data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	5
Class2 Poll (sec)	The D400 requests class 2 data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	5
Class3 Poll (sec)	The D400 requests class 3 data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	5
AI Poll (sec)	The D400 requests analog input data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Frozen AI Poll (sec)	The D400 requests frozen analog input data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0

Setting	Description	Range	Default
AI Change Poll (sec)	The D400 requests analog input event data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Frozen AI Change Poll (sec)	The D400 requests frozen analog input event data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Float AI Poll (sec)	The D400 requests single-precision analog input with flag at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
16-Bit AI Poll (sec)	The D400 requests 16-bit analog input with flag data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
32-Bit AI Poll (sec)	The D400 requests 32-bit analog input with flag data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
AO Poll (sec)	The D400 requests analog output status data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Float AO Poll (sec)	This request is never transmitted.	0 to 0	0
16-Bit AO Poll (sec)	The D400 requests 16-bit analog output status data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
32-Bit AO Poll (sec)	The D400 requests 32-bit analog output status data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
DI Poll (sec)	The D400 requests digital input data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
DI Change Poll (sec)	The D400 requests digital input event data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
DO Poll (sec)	The D400 requests digital output data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Acc Poll (sec)	The D400 requests static counter data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Acc Change Poll (sec)	The D400 requests counter event data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0

Setting	Description	Range	Default
Frozen Acc Poll (sec)	The D400 requests frozen counter data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0
Frozen Acc Change Poll (sec)	The D400 requests frozen counter event data at this interval (in seconds). If set to 0, the request is never transmitted.	0 to 36000	0

---

## 4.6 IEC 61850 Client

The D400 supports communications to IEC 61850 compliant devices using the IEC 61850 client application. The IEC 61850 Loader was specifically developed to assist in the configuration of the D400 for IEC 61850 server devices.

For information on how to configure the D400 for IEC 61850 communications, refer to the IEC 61850 Loader online help.

---

## 4.7 Hydran Client

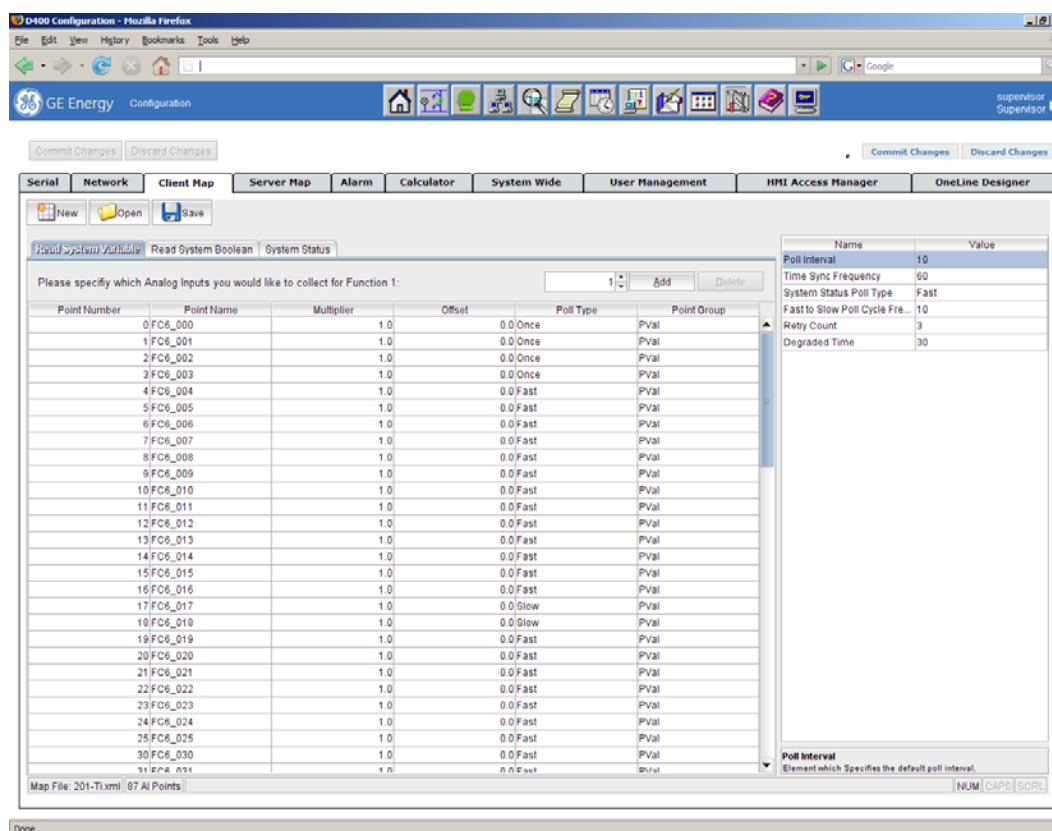
The Hydran Client map defines how the D400 is configured to poll data from Hydran devices. The D400 supports the following configurable Hydran data types:

- Read system variable – read from a register in a device
- Read system Boolean – read discrete inputs in a device
- System status – read discrete inputs such as alarm and alarm acknowledgement information in a device
- Device properties – device-level settings

Hydran Client map settings are available on the **Client Map** tab when a Hydran protocol device type is selected.



Figure 8 Hydran Client Map Page



### Read System Variable

Settings are available on the **Read System Variable** tab on the **Client Map** tab. The D400 provides mapping settings for read system variables as shown in Table 63.

**Table 63 Read System Variable Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the device Analog Input Map.	0 to 65535	Incremented from 0
Point Name	Text description of the point in the Analog Input Map.	Up to 128 characters	RSV xxx
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

Table 64 lists the available Poll Types.

**Table 64 Supported Poll Types**

Poll Type	Description
Fast	The application schedules requests to retrieve the values of Registers/Coils as quickly as possible, subject to the configured Inter-Poll Delay.
Slow	The application schedules requests to retrieve the values of Registers/Coils at a slower rate; requests occur once a Fast Poll Cycle Count cycle has been completed.
Once	The application schedules requests to retrieve the values of Registers/Coils once upon startup and subsequently whenever the device returns to an online state after communications failure.

### Read System Boolean

Settings are available on the **Read System Boolean** tab on the **Client Map** tab. The D400 provides mapping settings for read system Boolean points as shown in Table 65.

**Table 65 Read System Boolean Mapping Settings**

Setting	Description	Range	Default
Point #	Number of the point in the device Analog Input Map.	0 to 65535	Incremented from 0
Point Name	Text description of the point in the Analog Input Map.	Up to 128 characters	RSB xxx
ON State	Text description of the 1 state.	Up to 32 characters	ON
OFF State	Text description of the 0 state.	Up to 32 characters	OFF
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### System Status

Settings are available on the **System Status** tab on the **Client Map** tab. The D400 provides mapping settings for system status points as shown in Table 66.

**Table 66 System Status Mapping Settings**

Setting	Description	Range	Default
System Status Name	Text description of the point in the Analog Input Map.	Up to 128 characters	SS xxx
Word Position	Specifies the word index that contains the system status.	0 to 3	0
Bit Position	Specifies which resulting integer is used to determine the state of the DI	0 to 23	0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### Device Properties

Settings are available in the Device Properties pane on the right of the **Client Map** tab. Table 67 lists device-specific settings for the Hydran device.

**Table 67 Hydran Device Properties**

Setting	Description	Range	Default
Poll Interval	Time, in milliseconds, to wait between polls	0 to 65535	10
Time Sync Frequency	How often, in seconds, performing time synchronization should be performed with the remote device. If set to 0, time synchronization is disabled.	0 to 86400	60
System Status Poll Type	The polling rate of system status information	See Table 64	Fast
Fast to Slow Poll Frequency	Number of fast poll cycles before a slow poll cycle is initiated	1 to 255	10
Retry Count	The number of retries attempted before the device is assumed to be offline	0 to 255	3
Degraded Time	Time, in seconds, between attempts by the D400 to bring an offline device online	0 to 86400	30

## 4.8 SEL Binary

The SEL Binary Client map defines how the D400 is configured to poll data from SEL Fast Meter devices. The SEL client application uses ASCII messages to extract Protective Relay Fault (PRF) information from the SEL device. The D400 supports the following configurable SEL Binary data types:

- Fast Meter analog channel
- Demand analog channel
- Peak demand analog channel

- SER digital channel
- Device properties

The SEL Binary Client map settings are available on the **Client Map** tab when a SEL Binary protocol device type is selected.

**Note:** Additional SEL Binary configuration settings are available for device communications when configuring SEL serial connections on the **Serial** tab.

Figure 9 SEL Binary Client Map Page

D400 Configuration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

GE Energy Configuration

Commit Changes Discard Changes

Serial Network **Client Map** Server Map Alarm Calculator System Wide User Management HMI Access Manager OneLine Designer

New Open Save

Fast Meter Analog Input Demand Analog Input Peak Demand Analog Input SER Digital Input

Please specify which Analog Inputs you would like to collect for Function 1:

Point Name	Multiplier	Offset	Point Group
IA/V1 (Present Values)	1.0	0.0 PVal	
IB/W1 (Present Values)	1.0	0.0 PVal	
IC/W1 (Present Values)	1.0	0.0 PVal	
IA/V2 (Present Values)	1.0	0.0 PVal	
IB/V2 (Present Values)	1.0	0.0 PVal	
IC/V2 (Present Values)	1.0	0.0 PVal	

Number of Targets 1  
Number of Breakers 2  
Number of Remote Bits 4  
Pulse Remote Bits No  
Number of Calculation Blo. 2  
Block 1 Calculation Type 3 - Currents Only  
Block 2 Calculation Type 3 - Currents Only  
Block 3 Calculation Type 0 - Standard  
Block 4 Calculation Type 0 - Standard

Number of Targets  
The number of Target Rows returned by the device in the Fast Meter command.

Map File: SEL-507.xml | 5 AI Points

Done

Monday, February 11, 2008

### Fast Meter Analog Channel

Settings available on the **Fast Meter Analog Channel** tab on the **Client Map** tab. The D400 provides the mapping settings for fast meter analog outputs (Function code 1) as shown in Table 68.

Table 68 Fast Meter Analog Outputs

Setting	Description	Range	Default
Name	Text description of the point in the Fast Meter Analog Channel Map.	Up to 128 characters	FMA_xxx
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0

### Demand Analog Channel

Settings available on the **Demand Analog Channel** tab on the **Client Map** tab. The D400 provides the mapping settings for demand analog outputs (Function code 2) as shown in Table 69.

Table 69 Demand Analog Outputs

Setting	Description	Range	Default
Name	Text description of the point in the Demand Analog Channel Map.	Up to 128 characters	DAC_xxx
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64-bit Float	0.0

### Peak Demand Analog Channel

Settings available on the **Peak Demand Analog Channel** tab on the **Client Map** tab. The D400 provides the mapping settings for peak demand analog outputs (Function code 3) as shown in Table 70.

Table 70 Peak Demand Analog Outputs

Setting	Description	Range	Default
Name	Text description of the point in the Peak Demand Analog Channel Map.	Up to 128 characters	PDA_xxx
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	1.0

Setting	Description	Range	Default
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	0.0

### SER Digital Channel

Settings are available on the **SER Digital Channel** tab on the **Client Map** tab. The D400 provides the mapping settings for SER digital inputs (Function code 5) as shown in Table 71.

**Table 71 SER Digital Input Settings**

Setting	Description	Range	Default
Point Name	A text string that describes this point.	Up to 128 characters	SER_XXX
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON

### Device Properties

Settings are available in the **Device Properties** pane on the **Client Map** tab. Table 72 lists the poll-specific settings for the SEL Fast Meter device.

**Table 72 SEL Binary Device Properties**

Setting	Description	Range	Default
Name	Name of the device map file.	Up to 8 characters	<File name>
No. of Targets	Number of Target Rows returned by the device in the Fast Meter command	0 to 255	0
No. of Breakers	Number of Breakers supported by the Fast Operate message	1 to 10	0
No. of Remote Bits	Number of Remote Bits supported by the Fast Operate message	0 to 255	0
Pulse Remote Bits	If Pulsing of remote bits is supported by the Fast Operate message	Yes No	No
No. of Calculation Blocks	Number of Calculation blocks returned by the Fast Meter Definition Block	0 to 4	0

Setting	Description	Range	Default
Block1 Calculation Type	Type of calculations that is defined in Block 1	0: Standard Power 1: Delta Power 2: Voltages Only 3: Currents Only 4: Single Phase None	None
Block2 Calculation Type	Type of calculations that is defined in Block 2	0 to 4 None	None
Block3 Calculation Type	Type of calculations that is defined in Block 3	0 to 4 None	None
Block4 Calculation Type	Type of calculations that is defined in Block 4	0 to 4 None	None

## 4.9

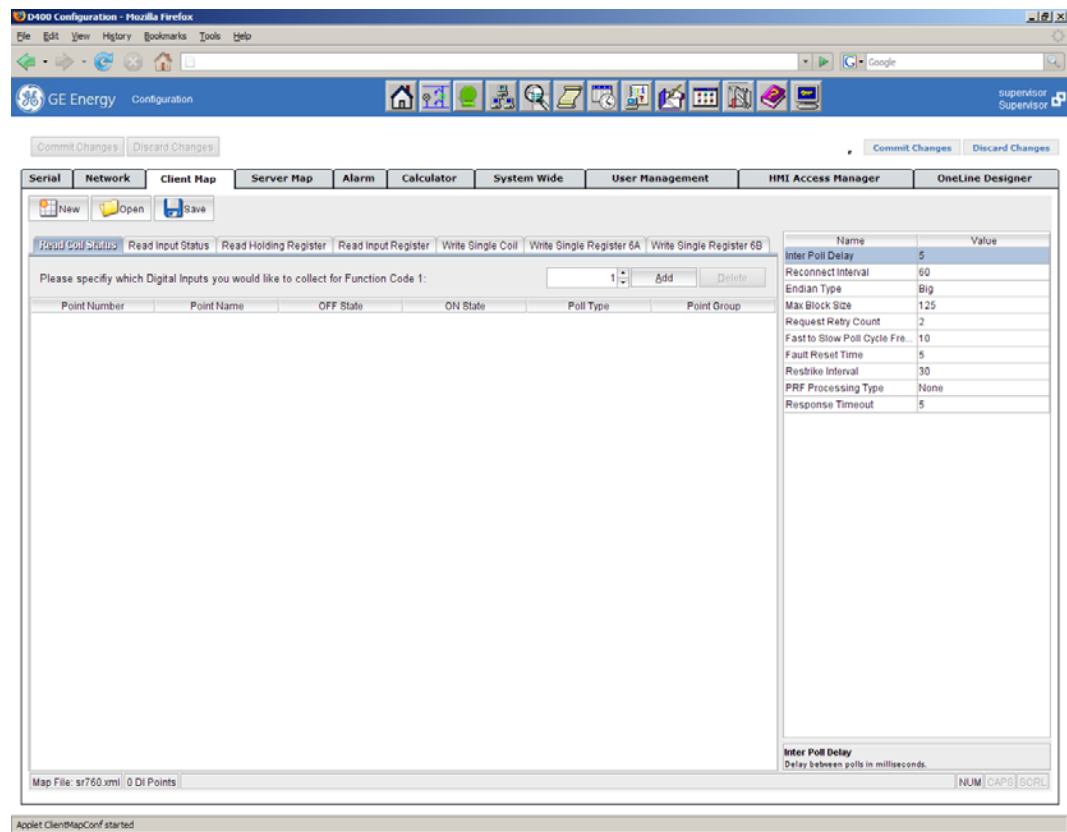
### MODBUS Client

The MODBUS Client map defines how the D400 is configured to poll data from MODBUS devices. The D400 supports the following configurable MODBUS data types:

- Read Coil Status – status of coils
- Read Input Status – digital input data
- Read Holding Register – holding registers of the device
- Read Input Register – input registers of the device
- Write Single Coil – set a single output to either ON or OFF in the device
- Write Single Register 6A – set a single holding register in the device (value required)
- Write Single Register 6B – set a single holding register in the device (value optional)

MODBUS Client map settings are available on the **Client Map** tab when a MODBUS protocol device type is selected.

Figure 10 MODBUS Client Map Page



Read Coil Status

Settings are available on the **Read Coil Status** tab on the **Client Map** tab. The D400 provides mapping settings for read coil status points as shown in Table 73.

Table 73 Read Coil Status Settings

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Coil xxx
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0



## Read Status Input

Settings are available on the **Read Status Input** tab on the **Client Map** tab. The D400 provides mapping settings for read status input points as shown in Table 74.

**Table 74 Read Status Input Settings**

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Input xxx
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

## Read Holding Register

Settings are available on the **Read Holding Register** tab on the **Client Map** tab. The D400 provides mapping settings for read holding register points as shown in Table 75.

**Table 75 Read Holding Register Settings**

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Holding Register xxx
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	0.0
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Data Type	The type of data polled	See Table 76	UINT16
ASCII Size	ASCII size, in bits, when a text string is being retrieved from the device. If this field is set to 0, the register does not contain ASCII data.	0 to 99	0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

Table 76 lists the available data types for **MODBUS Client** points.

**Table 76 Supported Data Types**

<b>Data Type</b>	<b>Description</b>
INT8	8-bit signed integer. Range: -128 to 127.
UINT8	8-bit unsigned integer. Range: 0 to 255.
INT16	16-bit signed integer. Range: -32768 to +32767.
UINT16	16-bit unsigned integer. Range: 0 to 65535.
INT32	32-bit signed integer. Range: -2147483648 to +2147483647.
UINT32	32-bit unsigned integer. Range: 0 to 4294967295.
FLOAT32	IEEE® single-precision floating point value.
DATE	Date in the format of DD-MMM-YYYY.
TIME	24 hour time in the format of HH:MM:SS.
ASCII	A string of ASCII data. Range as specified in ASCII Size.

### Read Input Register

Settings are available on the **Read Input Register** tab on the **Client Map** tab. The D400 provides mapping settings for read holding register points as shown in Table 77.

**Table 77 Read Input Register Settings**

<b>Setting</b>	<b>Description</b>	<b>Range</b>	<b>Default</b>
Point Number	A unique identifying number in the register map	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Input Register xxx
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	0.0
Poll Type	The type of poll to be taken of the point	See Table 64	Fast
Data Type	The type of data polled	See Table 76	UINT16
ASCII Size	ASCII size, in bits, when a text string is being retrieved from the device. If this field is set to 0, the register does not contain ASCII data.	0 to 99	0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### Write Single Coil

Settings are available on the **Write Single Coil** tab on the **Client Map** tab. The D400 provides mapping settings for write single coil points as shown in Table 78.

**Table 78 Write Single Coil Settings**

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map.	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Single Coil xxx
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON
Data Value	The value to be written to the point.	0000, FF00	FF00
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

**Write Single Register 6A**

Settings are available on the **Write Single Register 6A** tab on the **Client Map** tab. The D400 provides mapping settings for write single register 6A points as shown in Table 79.

**Table 79 Write Single Register 6A Settings**

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map.	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Single 6A Register xxx
OFF State Name	Text description of the 0 state.	Up to 32 characters	OFF
ON State Name	Text description of the 1 state.	Up to 32 characters	ON
Data Value	The value to be written to the point.	0000, FF00	FF00
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

**Write Single Register 6B**

Settings are available on the **Write Single Register 6B** tab on the **Client Map** tab. The D400 provides mapping settings for write single register 6B points as shown in Table 80.

**Table 80 Write Single Register 6B Settings**

Setting	Description	Range	Default
Point Number	A unique identifying number in the register map.	0 to 65535	x
Point Name	A text string that describes this point.	Up to 128 characters	Single 6B Register xxx
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	1.0

Setting	Description	Range	Default
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> ).	Full range of 64 bit Float	0.0
Point Group	Point group to which the point belongs.	List of defined point groups	Group assigned to ID number 0

### Device Properties

The D400 provides mapping settings for the MODBUS Client settings on the right side of the **Client** Map tab as shown in Table 81.

**Table 81 MODBUS Device Properties**

Setting	Description	Range	Default
Inter Poll Delay	Delay, in milliseconds, between polls	0 to 999	100
Reconnect Interval	Time, in seconds, between attempts by the D400 to bring an offline device online	1 to 3600	10
Endian Type	Endian data interpretation in the map file	Little, Big	Big
Max Block Size	The maximum block size, in bits, of MODBUS requests	0 to 255	255
Request Retry Count	The number of retries for each request	1 to 255	10
Fast to Slow Poll Cycle Frequency	Number of fast poll cycles before a slow poll cycle is initiated	0 to 255	10
Fault Reset Time	Time, in seconds, for which the fault parameter pseudo points retain values from the latest fault	0 to 3600	5
Restrike Interval	Once the first fault has occurred, the time to wait (in seconds) before updating the Fault Pseudo points with information if subsequent faults occur before this interval has elapsed	0 to 3600	30
PRF Processing Type	The PRF processing type to use	Pre-defined list of types	None
Response Timeout	The number of retries attempted before the device is assumed to be offline	100 to 65535	2000

# 5

## Configuring Masters

You can customize the D400 to transmit the necessary data from Intelligent Electronic Devices (IEDs) to master stations. Server applications in the D400 allow the D400 to retrieve selected data from event queues and the real-time database and send the data to the master station according to the how the SCADA protocol is defined.

The D400 configuration tool supports configuration of protocol-specific object references, scaling factors, and user-defined names for various objects configured for transmission. Where applicable, you can also configure additional device-level settings (for the same protocol) at the same time.

This chapter gives detailed information for configuring a DNP3 SCADA master. For step-by step information on using the configuration tool, refer to the D400 online Help.

---

## 5.1 Configuration Overview

Configuring server applications for use on the D400 typically includes the following activities:

1. Create D400 server map file for each master station and protocol type.
2. Select data points and assign point indices.
3. Configure protocol-specific settings.
4. Configure scaling and enable reverse scaling (reverse effect of scaling applied by a client application).
5. Set up serial and network master connections.
6. Configure protocol-specific settings for each master connection.
7. Save the configuration file.
8. Run the configuration file in the D400 by committing the changes.

---

## 5.2 Server Maps

SCADA master stations monitor many remote terminal units and gateway devices for certain critical information. The D400 forms an integral part of a SCADA system by collecting data from devices and then transmitting selected information to the master station as required. The D400 stores all the desired information for a master station in a “map” that lists and describes the selected data points from selected devices

The server map file is based on a specific protocol and specifies what information to present to a master. The map file contains information on how and when data is transmitted to a particular master station and the selected devices and data points.

The D400 includes a default DNP3 server map. You can use the default server map or customize it for your system requirements. Once you create a server map file, it becomes available to select on the Configuration page when assigning master connections.

### Creating Server Maps

#### » To create or edit a server map

1. On the **Configuration** page, select the **Server Map** tab.
2. Click **New** to create a new client map or **Open** to edit an existing server map.
3. Select the SCADA protocol type and then create or select the master map file.
4. Edit the data type and protocol settings as desired.
5. Click **Save** and enter a name for your map file.

**Tip** To create a custom mapping template, create a map file, click "Save" and enter a template name.

For more information on creating a server map, refer to the D400 online Help.

### Logical Remote Units

The D400 can be configured to function as several distinct instances. Each instance is called a Logical Remote Unit (LRU). It appears as a single, physical server to any master station communicating with the LRU.

The D400 can be configured to represent multiple Logical Remote Units (LRUs) to multiple master stations. The data presented to each master station may be identical or unique and can be achieved using multiple protocols simultaneously.

For example, the D400 can maintain a separate event queue for every master station configured in the system. If a data point is configured for presentation to eight master stations, an event on the point will cause eight events to be reported – one event to each master station.

### Communication Statistics

Server applications maintain communication statistics and other status information in the real-time database as pseudo points.

---

## 5.3 IEC 60870-5-101+104

The IEC 60870-5-101 and IEC 60870-5-104 Server applications allow remote master stations to retrieve and/or modify the information in the database of the D400 using the IEC 60870-5 protocol.

The IEC 60870-5-101+104 Server map defines how the D400 is configured to present data to IEC 60870-5 masters. You can create the following types of information objects:

- Bitstring
- Double Command
- Double Point
- Integrated Total
- Measurand
- Packed Single Point
- Regulating Command
- Root Directory
- Setpoint Command
- Single Command
- Single Point
- Step Position

## >> To create an Information Object

1. Click **Add Info Object**.
2. On the **New Info Object** window, enter values for the fields as described in Table 82 and click **OK**.
3. Configure each info object and add points to present to the master station.

**Table 82 Info Object Settings**

Setting	Description	Range
Info Object Type	The type of information object to create.	Bitstring Double Command Double Point Integrated Total Measurand Packed Single Point Regulating Command Root Directory Setpoint Command Single Command Single Point Step Position
Info Object Name	An identifier used within the configuration interface.	1 to 128 ASCII characters
Starting Info Object Address	Starting address for this object.	1 to 16777215

The table directly below the Info Object type drop-down menu shows the configured values for the selected Info Object. Info Object Name cannot be edited in this table.

## Bitstring

**Table 83 Bitstring Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Address	The address of this entry.	1 to 16777215	
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include



Setting	Description	Range	Default
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1
Periodic Update Mode	The type of periodic updating	Not Used Background Scan	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	0 to 65535	0
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
<i>Per-Point Settings</i>			
Bit Position		1 to 32	Incremented from 1
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Invert	Select if the value of the mapped points should be inverted.	True or False	False

## Double Command

**Table 84 Double Command Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None

Setting	Description	Range	Default
<i>Per-Point Settings</i>			
Address	The address of this entry. Read only.	N/A	N/A
Control Type	The type of control to operate.	Trip/Close Regulating Persistent	Persistent
Short Pulse Duration	The control duration (in seconds) of the short pulse output.	1 to 2147483647	1000
Long Pulse Duration	The control duration (in seconds) of the long pulse output.	1 to 2147483647	2000
Transmission Type	The type of transmission used for control command execution; either a select and execute command sequence or direct execute command sequence.	Select and Execute Direct Execute	Select and Execute
Source Point One	First of two digital input source points selected from the Point Picker to comprise the 4 state point being monitored. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Source Point Two	Second of two digital input source points selected to comprise the 4 state point being monitored.	List of points based on configured DIs.	N/A

## Double Point

**Table 85 Double Point Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1

Setting	Description	Range	Default
Periodic Update Mode	The type of periodic updating	Not Used Background Scan	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	0 to 65535	0
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
Valid Time	The minimum amount of time (in milliseconds) that both digital input points must be stable before an ON or OFF state is reported. -1 disables this setting.	-1 to 65535	-1
Suppress Time	The minimum amount of time (in milliseconds) that both digital input points must be stable before an indeterminate state is reported. -1 disables this setting.	-1 to 65535	-1
<i>Per-Point Settings</i>			
Address	The address of the entry. Read only.	N/A	N/A
Source Point One	First of two digital input source points selected from the Point Picker to comprise the 4 state point being monitored. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Source Point Two	Second of two digital input source points selected to comprise the 4 state point being monitored.	List of points based on configured DIs.	N/A
Invert	Select if the value of the mapped points should be inverted.	True or False	False

## Integrated Total

Table 86 Integrated Total Mapping Settings

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	

Setting	Description	Range	Default
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
<i>Per-Point Settings</i>			
Address	Read only.	N/A	N/A
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Accumulator Type	Specifies whether every change (transition) or every pair of changes (pulse) in the monitored accumulator point value increments the reported count.	Pulse Transition	Pulse
Accumulator Return Type	Specifies whether the running or frozen accumulator value is reported.	Running Frozen	Running
Accumulator Freeze	Specifies whether or not the master station is allowed to freeze the monitored accumulator point.	Enabled Disabled	Disabled
Accumulator Clear	Specifies whether or not the master station is allowed to clear the monitored accumulator point.	Enabled Disabled	Disabled
Threshold	Specifies the minimum change in accumulator value required to produce a spontaneous report or event.  Only used when the Accumulator Return Type is <i>Running</i> .	0 to 1000000	1

## Measurand

Table 87 Measurand Mapping Settings

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1
Periodic Update Mode	The type of periodic updating	Not Used Background Scan Periodic/Cyclic	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	0 to 65535	0
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
Conversion	The type of setpoint command. There are 3 possible types: <ul style="list-style-type: none"> <li>Normalized - value is between -1 and +1 -2<sup>-15</sup></li> <li>Scaled - value is scaled using multiplier and offset to -2<sup>15</sup> to +2<sup>15</sup> - 1</li> <li>Short Floating Point - value is a 32-bit floating point.</li> </ul>	Normalized Scaled ShortFP	Normalized

Setting	Description	Range	Default
Quality	Whether or not quality information is included with this entity.	With Quality Descriptor Without Quality Descriptor	With Quality Descriptor
<i>Per-Point Settings</i>			
Address	The address of this entity. Read only.	N/A	N/A
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0
Polarity	Specifies whether or not a negative analog value is valid.	Bipolar Value Unipolar Value	Bipolar Value
Threshold	The initial minimum change in the analog input value that is required in order to produce a spontaneous report or event.	0 to 1,000,000,000	5
High Limit	The initial high limit that is required for an analog input value to exceed in order to produce an event.	-1.0E+12 to 1.0E+12	1.0E+12
Low Limit	The initial low limit that is required for an analog input value to exceed in order to produce an event.	-1.0E+12 to 1.0E+12	-1.0E+12

### Packed Single Point

Table 88 Packed Single Point Mapping Settings

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Address	The address of this entry.	N/A	N/A
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include

Setting	Description	Range	Default
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1
Periodic Update Mode	The type of periodic updating	Not Used Background Scan	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	0 to 65535	0
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
<i>Per-Point Settings</i>			
Bit Position	Specifies the bit position within the information object element.	1 to 32	Incremented from 1
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Invert	Select if the value of the mapped points should be inverted.	True or False	False

## Regulating Command

**Table 89 Regulating Command Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
<i>Per-Point Settings</i>			
Address	The address of this entry. Read only.	N/A	N/A
Control Type	The type of control to operate.	Trip/Close Regulating Persistent	Persistent

Setting	Description	Range	Default
Short Pulse Duration	The control duration (in seconds) of the short pulse output.	1 to 2147483647	1000
Long Pulse Duration	The control duration (in seconds) of the long pulse output.	1 to 2147483647	2000
Transmission Type	The type of transmission used for command control execution; either a select and execute command sequence or direct execute command sequence.	Select and Execute Direct Execute	Select and Execute
Source Point One	First of two digital input source points selected from the Point Picker to comprise the 4 state point being monitored. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Source Point Two	Second of two digital input source points selected to comprise the 4 state point being monitored.	List of points based on configured DIs.	N/A

### Root Directory

Table 90 Root Directory Mapping Settings

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Address	The address of this entry.		

### Setpoint Command

Table 91 Setpoint Command Mapping Settings

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None



Setting	Description	Range	Default
Conversion	The type of setpoint command. There are 3 possible types: <ul style="list-style-type: none"> <li>Normalized - value is between -1 and +1 -2<sup>-15</sup></li> <li>Scaled - value is scaled using multiplier and offset to -2<sup>15</sup> to +2<sup>15</sup> - 1</li> <li>Short Floating Point - value is a 32-bit floating point.</li> </ul>	Normalized Scaled ShortFP	Normalized
<i>Per-Point Settings</i>			
Address	The address of this entry. Read only.	N/A	N/A
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0
Polarity	Specifies whether or not a negative analog value is valid.	Bipolar Value Unipolar Value	Bipolar Value
Transmission Type	The type of transmission used for control command execution; either a select and execute command sequence or only an execute command sequence.	Select and Execute Direct Execute	Select and Execute
Send Ackterm	Specifies whether the application sends an ACTTERM response to the master station when a C_SE setpoint command completes	No Yes	No

## Single Command

**Table 92 Single Command Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None

Setting	Description	Range	Default
<i>Per-Point Settings</i>			
Address	The address of this entry. Read only.	N/A	N/A
Control Type	The type of control to operate.	Trip/Close Regulating Persistent	Persistent
Short Pulse Duration	The control duration (in seconds) of the short pulse output.	1 to 2147483647	1000
Long Pulse Duration	The control duration (in seconds) of the long pulse output.	1 to 2147483647	2000
Transmission Type	The type of transmission; either a select and execute command sequence or only an execute command sequence.	Select and Execute Direct Execute	Select and Execute
Source Point One	First of two digital input source points selected from the Point Picker to comprise the 4 state point being monitored. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Source Point Two	Second of two digital input source points selected to comprise the 4 state point being monitored.	List of points based on configured DIs.	N/A

### Single Point

**Table 93 Single Point Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.	1 to 16777215	
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1

Setting	Description	Range	Default
Periodic Update Mode	The type of periodic updating	Not Used Background Scan	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	0 to 65535	0
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
<i>Per-Point Settings</i>			
Address	The address of the entity.		
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Invert	Select if the value of the mapped points should be inverted.	True or False	False

## Step Position

**Table 94 Step Position Mapping Settings**

Setting	Description	Range	Default
<i>Info Object Settings</i>			
Info Object Name	The name of the information object as entered on the New Info Object window. Read only.	N/A	N/A
Starting Address	The starting address of this entry.		
Interrogation Group	The interrogation group used for reporting this information object.	Not Used Group 1 ... Group 16	Not Used
Interrogation Response	Specify whether to include this information object in a general interrogation response.	Include Exclude	Include
Report Class	Specify if spontaneous events for this object are reported as class 1 or class 2 messages. Applies to unbalanced mode and spontaneous events only.	Class 1 Class 2	Class 1

Setting	Description	Range	Default
Periodic Update Mode	The type of periodic updating	Not Used Background Scan	Not Used
Periodic Update Interval	The time (in seconds) between periodic reports. Used only if Periodic Update Mode is not set to <i>Not Used</i> .	1 to 255	60
Periodic Report On Power Up	Specify if periodic reporting (if enabled) should begin immediately upon startup.	Disabled Enabled	Disabled
Time Tag	The type of time tag to use.	None With Time Tag With CP56 Time Tag	None
<i>Per-Point Settings</i>			
Address	The address of the entity.		
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0
Polarity	Specifies whether or not a negative analog value is valid.	Bipolar Value Unipolar Value	Bipolar Value
Threshold	The initial minimum change in the analog input value that is required in order to produce a spontaneous report or event.	0 to 100,000,000	5
High Limit	The initial high limit that is required for an analog input value to exceed in order to produce an event.	-1.0E+12 to 1.0E+12	1.0E+12
Low Limit	The initial low limit that is required for an analog input value to exceed in order to produce an event.	-1.0E+12 to 1.0E+12	-1.0E+12

## 5.4 DNP3 Server

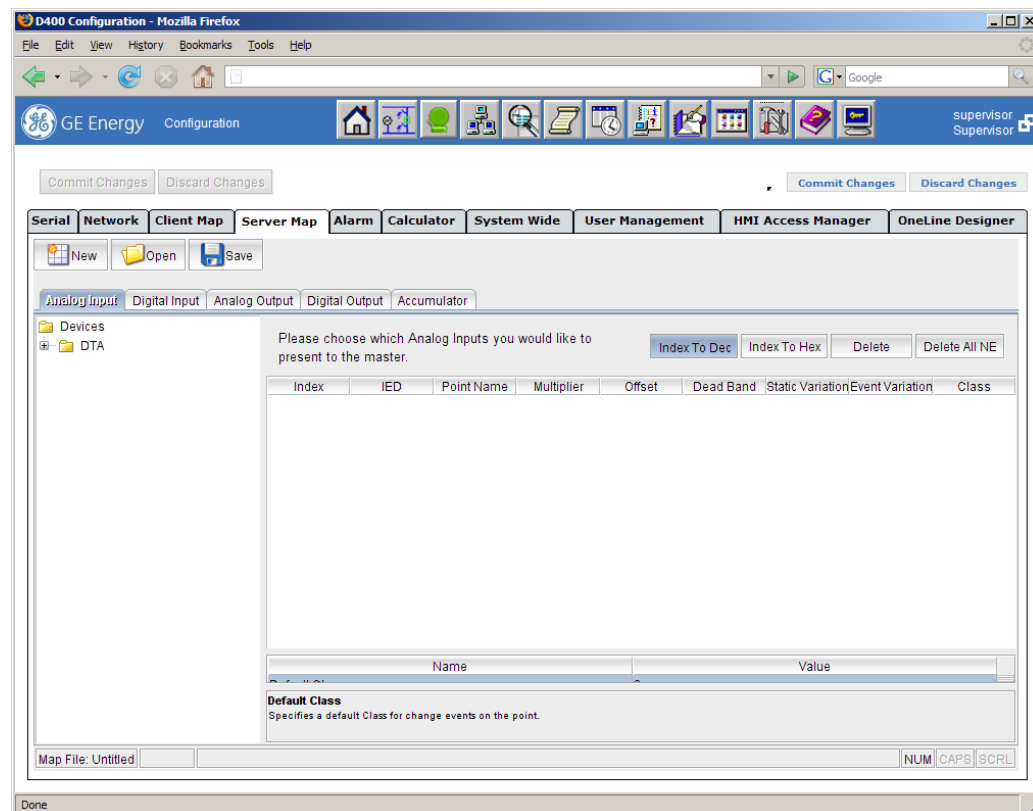
The DNP3 Server application allows a remote master station to retrieve and/or modify the information in the database of the D400 using the DNP3 protocol. Because the DNP3 server application supports device-level addressing, it can access the full range of addresses supported by the protocol. For example, for DNP3, all master station addresses are user configurable per the DNP3 address range of 0 to 65519.

The DNP3 Server map defines how the D400 is configured to present data to DNP3 masters. The D400 supports the following configurable DNP3 data types:

- Analog inputs - measured or computed values by the device
- Digital inputs - states of physical or logical Boolean devices
- Analog outputs - physical or computed analog quantities
- Digital outputs - physical or logical ON-OFF, raise-lower, and trip-close points
- Accumulators - counter values
- Device properties – device-level settings

The DNP3 Server map settings are available on the **Server Map** tab when a DNP3 SCADA protocol type is selected.

Figure 11 DNP3 Server Map Page



## Analog Inputs

Settings are available on the **Analog Inputs** tab. The default property values are defined in the lower pane. The D400 provides the mapping settings for analog inputs as shown in Table 95.

**Table 95 Analog Input Mapping Settings**

Setting	Description	Range	Default
Index	Point Index (0 Based). Each point index number must be unique.	0 to 65535	Incremented from 0.
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected AI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Analog Input map. Based on selected AI point. Read only.	Up to 128 characters	Assigned IED point name.
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0
Dead Band	Minimum change in the AI point value that constitutes an event. A value of 0 disables event generation for the point.	0 to 65535	User selected Default
Static Variation	How the point values should be reported.	32-Bit 16-Bit 32-Bit w/o flag 16-Bit w/o flag 32-Bit Float	User selected Default
Event Variation	Indicates how an event on this point should be reported.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time 32-Bit Float with Time 32-Bit Float without Time	User selected Default
Class	Default Class for change events on the point.	None 3 2 1	User selected Default

Settings are available in the lower pane of the **Analog Inputs** tab. The configuration settings defined in Table 96 are used to configure the default values for all analog input points defined in the DNP3 server map.

**Table 96 Analog Input Properties**

Setting	Description	Range	Default
Default Class Assignment	All AI events belong to this class by default.	None 3 2 1	2
Default Static Variation	Type to report, when the master does not request any specific type.	32-Bit 16-Bit 32-Bit w/o flag 16-Bit w/o flag 32-Bit Float	32-Bit
Default Event Variation	Type to report, when the master does not request any specific type.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time 32-Bit Float with Time 32-Bit Float without Time	32-Bit with Time
Default Dead Band	Minimum change in the AI point value that constitutes an event. A value of 0 disables event generation for the point.	0-65535	5

## Digital Inputs

Settings are available on the **Digital Inputs** tab. The default property values are defined in the lower pane. The D400 provides the mapping settings for digital inputs as shown in Table 97.

**Table 97 Digital Input Mapping Settings**

Setting	Description	Range	Default
Index	Point Index (0 Based). Each point index number must be unique.	0 to 65535	Incremented from 0.
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DI point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Binary Input map. Based on selected DI point. Read only.	Up to 128 characters	Assigned IED point name.
Invert	Select if the value of the mapped points should be inverted.	True or False	False

Setting	Description	Range	Default
Static Variation	How the point values should be reported.	32-Bit 16-Bit 32-Bit w/o flag 16-Bit w/o flag 32-Bit Float	User selected Default
Event Variation	Indicates how an event on this point should be reported.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time 32-Bit Float with Time 32-Bit Float without Time	User selected Default
Class	Default Class for change events on the point.	None 3 2 1	User selected Default

Settings are available in the lower pane of the **Digital Inputs** tab. The configuration settings defined in Table 98 are used to configure the default values for all digital input points defined in the DNP3 server map.

**Table 98 Digital Input Properties**

Setting	Description	Range	Default
Default Class Assignment	All DI events belong to this class by default.	None 3 2 1	1
Default Static Variation	Type to report, when the master does not request any specific type.	With Status Without Status	With Status
Default Event Variation	Type to report, when the master does not request any specific type.	With Time Without Time	With Time

### Analog Outputs

Settings are available on the **Analog Outputs** tab. The default property values are defined in the lower pane. The D400 provides the mapping settings for analog outputs as shown in Table 99.



**Table 99 Analog Output Mapping Settings**

Setting	Description	Range	Default
Index	Point Index (0 Based). Each point index number must be unique.	0 to 65535	Incremented from 0.
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected AO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Analog Output map. Based on selected AO point. Read only.	Up to 128 characters	Assigned IED point name.
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0
Static Variation	How the point values should be reported.	32-Bit 16-Bit 32-Bit w/o flag 16-Bit w/o flag 32-Bit Float	User selected Default

Settings are available in the lower pane of the **Analog Outputs** tab. The configuration settings defined in Table 100 are used to configure the default values for all analog output points defined in the DNP3 server map.

**Table 100 Analog Output Properties**

Setting	Description	Range	Default
Default Static Variation	Type to report, when the master does not request any specific type.	32-Bit 16-Bit	32-Bit

## Digital Outputs

Settings are available on the **Digital Outputs** tab. The default property values are defined in the lower pane. The D400 provides the mapping settings for digital outputs as shown in Table 101.

**Table 101 Digital Output Mapping Settings**

Setting	Description	Range	Default
Index	Point Index (0 Based). Each point index number must be unique.	0 to 65535	Incremented from 0.
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Digital Output map. Based on selected DO point. Read only.	Up to 128 characters	Assigned IED point name.

Setting	Description	Range	Default
Supported Command	Command the DNP3 server should expect. If the DNP3 server receives a command that is not configured, it will reject the command.	All operations SBO Only	User selected Default

Settings are available in the lower pane of the **Digital Outputs** tab. The configuration settings defined in Table 102 are used to configure the default values for all digital output points defined in the DNP3 server map.

**Table 102 Digital Output Properties**

Setting	Description	Range	Default
Default Command Supported	The DNP3 server uses this as the default command to support, when the master does not request any specific type.	All operations SBO Only	SBO Only

### Accumulators

The accumulators are used for reporting running values, frozen values, and events. This means that the same DNP3 point index is used for both the running and frozen value. The DNP3 server returns the running value when data points for Static Variation (Object 20) is requested by the master station. The DNP3 server returns the frozen value when data points for Static Variation (Object 21) is requested by the Master station. The Threshold configured is used to qualify events for running accumulators only Event Variation (Object 22). Frozen accumulator events (Object 23) are generated whenever a configured accumulator is frozen.

Settings are available on the **Accumulators** tab. The default property values are defined in the lower pane. The D400 provides the mapping settings for accumulators (counters) as shown in Table 103.

**Table 103 Accumulator Mapping Settings**

Setting	Description	Range	Default
Index	Point Index (0 Based). Each point index number must be unique.	0 to 65535	Incremented from 0.
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected ACC point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Accumulator map. Based on selected ACC point. Read only.	Up to 128 characters	Assigned IED point name.
Threshold	Minimum change required in the Running Accumulator count to cause an event to be generated. 0 will disable generation of Running Accumulator Events.	0 to 5000	User selected Default
Static Variation	How the point values should be reported. Applies to Running value.	32-Bit 16-Bit	User selected Default

Setting	Description	Range	Default
Event Variation	Indicates how an event on this point should be reported. Applies to Running value.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	User selected Default
Frozen Static Variation	How the point values should be reported. Applies to Frozen value.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	User selected Default
Frozen Event Variation	Indicates how an event on this point should be reported. Applies to Frozen value.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	User selected Default
Class	Default Class for change events on the point.	None 3 2 1	User selected Default

Settings available in the lower pane on the **Accumulators** tab. The configuration settings defined in Table 104 are used to configure the default values for all accumulator points defined in the DNP3 server.

**Table 104 Accumulator Properties**

Setting	Description	Range	Default
Default Class Assignment	All ACC Events belong to this class by default	None 3 2 1	3
Default Static Variation (Object 20 and 21)	Type to report, when the master does not request any specific type.	32-Bit 16-Bit	32-Bit
Default Event Variation (Object 22 and 23)	Type to report, when the master does not request any specific type.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	32-Bit with Time

Setting	Description	Range	Default
Frozen Static Variation	Type to report, when the master does not request any specific type.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	32-Bit with Time
Frozen Event Variation	Type to report, when the master does not request any specific type.	32-Bit with Time 32-Bit without Time 16 Bit with Time 16 Bit without Time	32-Bit with Time
Default Threshold	Minimum change in the ACC point value that constitutes an event.	0 to 5000	0

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## 5.5 MODBUS Server

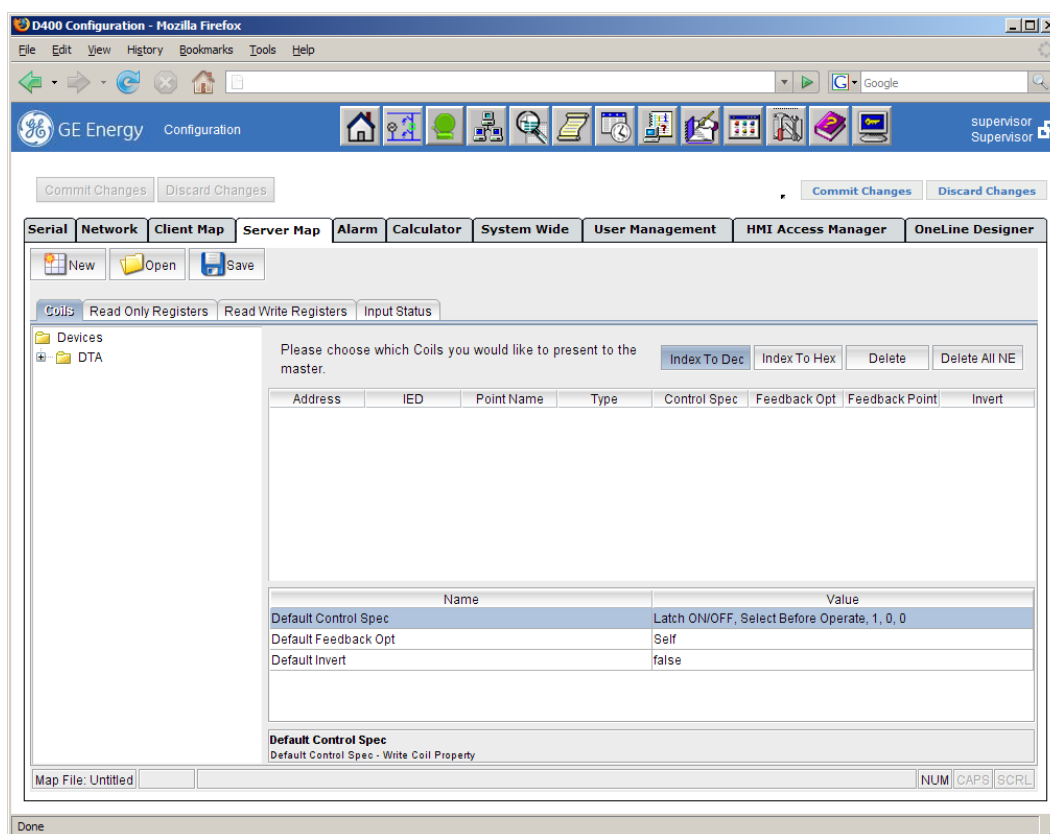
The MODBUS Server application allows a remote master station to retrieve and/or modify the information in the database of the D400 using the MODBUS protocol.

The MODBUS Server map defines how the D400 is configured to present data to MODBUS masters. The D400 supports the following configurable MODBUS data types:

- Coils
- Read Only Registers
- Read Write Registers
- Input Status

The MODBUS Server map settings are available on the **Server Map** tab when a MODBUS protocol type is selected.

Figure 12 MODBUS Server Map Page



## Coils

Mapping settings are available in the upper pane of the **Coils** tab as shown in Table 105

Table 105 Coil Mapping Settings

Setting	Description	Range	Default
Address	The MODBUS address assigned to the point	0 to 65535	X
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Digital Output map. Based on selected DO point. Read only.	Up to 128 characters	Assigned IED point name
Type	The point type. Read only.	DI, DO	Assigned type
Control Spec	See Table 106. Only enabled for DO type points.		
Feedback Opt	If set to <i>Self</i> , the values of the DO points are returned. If set to <i>Digital Inputs</i> , the value of the Digital Input point is returned. Only enabled for DO type points.	Self DigitalInput	Self
Feedback Point	If Feedback Opt is set to <i>Digital Input</i> , the point selected will be returned.	List of points based on configured DIs	N/A

Setting	Description	Range	Default
Invert	Select if the value of the mapped points should be inverted. Only enabled for DI points.	True or False	False

**Table 106 Control Specification Properties**

Setting	Description	Range	Default
Control Code	The control commands that the IED will accept	Latch ON/OFF Pulse ON/OFF TRIP/CLOSE	Latch ON/OFF
Function Code	The protocol function code to pass as part of the digital control command sent to a device.	Select Before Operate Direct Operate	Select Before Operate
Count	Number of times to consecutively repeat a control code, applying the pulse on and pulse off times to each control pulse repetition (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close).	1 to 255	1
On Time	Duration, in milliseconds, of an ON pulse	0 to 65535	0
Off Time	Duration, in milliseconds, of an OFF pulse	0 to 65535	0

Property settings are available in the lower pane of the **Coils** tab. The configuration settings defined in Table 107 are used to configure the default values for all coils defined in the MODBUS server map.

**Table 107 Coil Properties**

Setting	Description	Range	Default
Default Control Spec	See Table 108.		
Default Feedback Opt	If set to <i>Self</i> , the values of the DO points are returned. If set to <i>Digital Inputs</i> , the value of the Digital Input point is returned.	Self DigitalInput	Self
Default Invert	Select if the value of the mapped points should be inverted by default	True or False	False

**Table 108 Default Control Specification Properties**

Setting	Description	Range	Default
Default Control Code	The control commands that the IED will accept by default	Latch ON/OFF Pulse ON/OFF TRIP/CLOSE	Latch ON/OFF
Default Function Code	The default protocol function code to pass as part of the digital control command sent to a device.	Select Before Operate Direct Operate	Select Before Operate

Setting	Description	Range	Default
Default Count	Number of times to consecutively repeat a control code, applying the pulse on and pulse off times to each control pulse repetition (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close).	1 to 255	1
Default On Time	Default duration, in milliseconds, of an ON pulse	0 to 65535	0
Default Off Time	Default duration, in milliseconds, of an OFF pulse	0 to 65535	0

### Read Only Registers

Mapping settings are available on the **Read Only Registers** tab as shown in Table 109.

**Table 109 Read Only Register Mapping Settings**

Setting	Description	Range	Default
Address	The MODBUS address assigned to the point	0 to 65535	X
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Digital Output map. Based on selected DO point. Read only.	Up to 128 characters	Assigned IED point name
Type	The point type. Read only.	DI, AI, AO, ACC	Assigned type
Data Format	The type of data polled	See Table 76	INT16
Point Value to Use	The attribute of the point to be polled	Value Frozen Value Date and Time Freeze Date and Time	Value
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0

Property settings are available in the lower pane of the **Read Only Registers** tab. The configuration settings defined in

Table 110 are used to configure the default values for all read only registers defined in the MODBUS server map.



Table 110 Read Only Register Properties

Setting	Description	Range	Default
Default Point Value To Use	The attribute of the point that should be polled by default	Value Frozen Value Date and Time Freeze Date and Time	Value
Default Multiplier	Default scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Default Offset	Default scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0

### Read Write Registers

Mapping settings are available on the upper pane of the **Read Write Registers** tab as shown in Table 111.

Table 111 Read Write Register Mapping Settings

Setting	Description	Range	Default
Address	The MODBUS address assigned to the point	0 to 65535	X
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Digital Output map. Based on selected DO point. Read only.	Up to 128 characters	Assigned IED point name
Type	The point type. Read only.	DI, AI, AO, ACC	Assigned type
Data Format	The type of data polled	See Table 76	INT16
Point Value to Use	The attribute of the point to be polled	Value Frozen Value Date and Time Freeze Date and Time	Value
Multiplier	Scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Offset	Scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0

Property settings are available in the lower pane of the **Read Write Registers** tab. The configuration settings defined in Table 111 are used to configure the default values for all read write registers defined in the MODBUS server map.

**Table 112 Read Write Register Properties**

Setting	Description	Range	Default
Default Point Value To Use	The attribute of the point that should be polled by default	Value Frozen Value Date and Time Freeze Date and Time	Value
Default Multiplier	Default scale factor of the point ( <b>m</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	1.0
Default Offset	Default scale factor of the point ( <b>b</b> of formula <b>mx + b</b> )	Full range of 64-bit Float	0.0

### Input Status

Mapping settings are available on the upper pane of the **Input Status** tab as shown in Table 113.

**Table 113 Input Status Mapping Settings**

Setting	Description	Range	Default
Address	The MODBUS address assigned to the point	0 to 65535	X
IED	System Point Identifier. Consists of Home Directory and Point Name. Based on selected DO point from the Point Picker. Read only.	N/A	System Assigned Identifier
Point Name	Text description of the point in the Digital Output map. Based on selected DO point. Read only.	Up to 128 characters	Assigned IED point name
Type	The point type. Read only.	DI, AI, AO, ACC	Assigned type
Invert	Select if the value of the mapped points should be inverted	True or False	False

Property settings are available in the lower pane of the **Input Status Mapping** tab. The configuration settings defined in Table 114 are used to configure the default values for all read write registers defined in the MODBUS server map.

**Table 114 Input Status Properties**

Setting	Description	Range	Default
Default Invert	Select if the value of the mapped points should be inverted by default	True or False	False

# 6

## Configuring D400 Automation Applications

The D400 Automation applications retrieve data from the real-time database, manipulate the data and store the results in the real-time database. The type of data supported by the automation applications varies depending on the application. The D400 currently supports the following automation applications:

- Alarm (Annunciator)
- Calculator
- LogicLinx (optional)

---

### 6.1 Configuration Overview

Configuring automation applications for use on the D400 typically includes the following steps:

1. Select data points.
2. Define application points.
3. Set up the point manipulations and associated settings.
4. Save and run the configuration file by committing the changes.

## 6.2 Alarm

In the substation-monitoring environment, alarms are used to indicate the occurrence of an event that requires attention, for example, the opening of a breaker due to an over-current condition.

The D400 Annunciator monitors a given set of digital input points for alarm conditions. Each configured alarm has three points associated with it in the D400 system: two digital input points and one analog input point.

Upon detecting an alarm condition on a source point or a group of points, the Annunciator creates a record in the D400 database and presents the alarm to the operator on the D400 Active Alarms page for further action. Once an alarm is acknowledged it is archived by moving it from the Active Alarms page to the Historical Alarms page.

### Alarm Types

The following alarms types are configurable for the D400 Annunciator:

- **Absolute (2-state):** Generates an active alarm when the point state changes from normal to alarmable, and archives the alarm only when the point state returns to normal *and* the alarm is acknowledged.
- **On Update (2-state):** Generates an active alarm when the alarm state changes from one state to another, and archives the alarm when the alarm is acknowledged. In effect, two alarms are created: the first alarm is generated when the source point changes from ON to OFF, and a second alarm is generated when the source point changes from OFF to ON.
- **Four State:** Generates an active On Update alarm when the point values change to a state configured as an On Update alarm and generates an active Absolute alarm when the point values change to a state configured as an Absolute alarm. The On Update alarm is archived when it is acknowledged. The four-state Absolute alarm is archived once it is acknowledged and the pair of source points have moved into a non-alarmable state – for example, a change to a state that has an On Update alarm will not reset the alarm. Four state alarms must have at least one non-alarmable state.

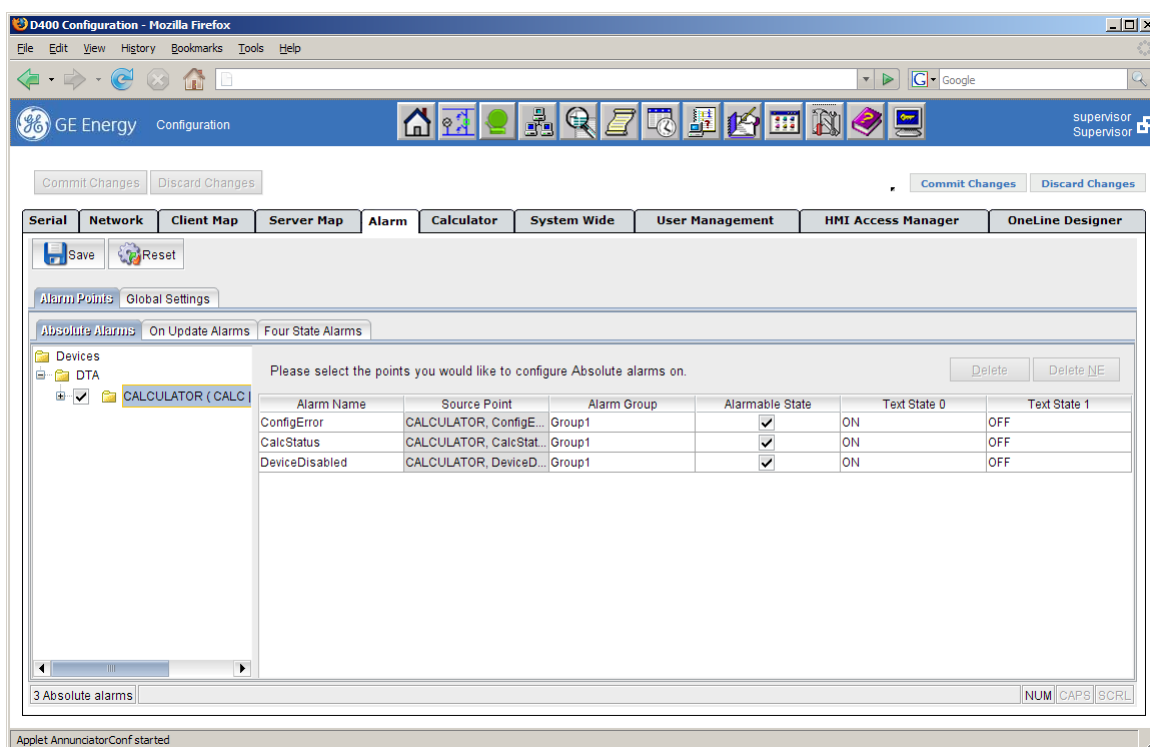
### Setting Up Alarms

You set up alarm points for the D400 on the **Alarm** tab on the **Configuration** page. Alarms must be configured to activate the **Active Alarms** page in the D400 HMI.

The **Point Picker** lists the digital inputs currently configured in the system that are available for selection as alarm points. The selected points appear on the alarm type tab for configuration. You can configure a maximum of 10,000 alarms (all types).

**Note:** Digital points must already be configured in the D400 before they can be selected as alarmable points.

Figure 13 Alarm Configuration Page



## » To configure the D400 Annunciator

1. On the **Configuration** page, select the **Alarm** tab.
2. Select and configure points for each alarm type: **Absolute Alarms, On Update Alarms, Four State Alarms**.
3. Configure settings for group alarms.
4. Configure global settings for alarms.

### Alarm Points Configuration

The Annunciator supports the configuration of a maximum of 10,000 alarm points, where each alarm point is uniquely linked with one digital input point (for a 2-state alarm) or two digital input points (for a 4-state alarm) in the system point database, based on the configured alarm point's alarm type. Points selected for an Alarm Four State type can be contiguous or non-contiguous points, in the same device, or across two different devices.

## » To configure alarm points

- On the **Alarm Points Configuration** tab, select and configure points from the **Point Picker** for each alarm type: **Absolute Alarms, On Update Alarms, Four State Alarms**.

Settings are available on the **Absolute Alarms, On Update Alarms, Four State Alarms** tabs respectively. The D400 provides the alarm configuration settings as listed in Table 115, Table 116 and Table 117.

**Note:** To clearly distinguish alarms on the Active Alarms page, it is highly recommended to configure alarms with a unique combination of Line ID, Device ID and Alarm name. The “Automatically create unique alarm point names” option on the Global settings tab assists in alarm point naming by prefixing alarm points with a unique identifier. See Table 122.

**Table 115 Absolute Alarms Settings**

Setting	Description	Range	Default
Alarm Name	Text description of the alarmable point as it will be displayed in the Active Alarms page. It defaults to the name of the source point.	Up to 100 alphanumeric characters	DI source Point name
Source Point	DI source point selected from the Point Picker. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Alarm Group	Single alarm group to which the point's alarm is to be associated with. All configuration information for the alarm group (e.g. color and sound settings) is applied to every point associated with the alarm group.	1 to 4	N/A
Alarmable State	Indicates when the point value is considered to be in the alarmable state: Off (False) or On (True).	True False	True
Text State 0	Text to display to represent the point state when the associated digital input point value becomes 0, typically the Normal state.	1 to 32 alphanumeric characters	Off
Text State 1	Text to display to represent the point state when the associated digital input point value becomes 1, typically the Alarm state.	1 to 32 alphanumeric characters	On

**Table 116 On Update Alarm Settings**

Setting	Description	Range	Default
Alarm Name	Text description of the alarmable point as it will be displayed in the Active Alarms page. It defaults to the name of the source point.	Up to 100 alphanumeric characters	DI source Point name
Source Point	DI source point selected from the Point Picker. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Alarm Group	Single alarm group to which the point's alarm is to be associated with. All configuration information for the alarm group (e.g. color and sound settings) is applied to every point associated with the alarm group.	1 to 4	N/A
ACK Method	Selected method to acknowledge the alarm: manually by the user, or automatically by the D400 when generated (and then immediately archived).	Manual Automatic	Manual

Setting	Description	Range	Default
Text State 0	Text to display to represent the point state when the associated digital input point value becomes 0, typically the Normal state.	1 to 32 alphanumeric characters	Off
Text State 1	Text to display to represent the point state when the associated digital input point value becomes 1., typically the Alarm state.	1 to 32 alphanumeric characters	On

**Table 117 Four State Alarm Settings**

Setting	Description	Range	Default
Alarm Name	Text description of the alarmable point as it will be displayed in the Active Alarms page. It defaults to the name of the source point.	Up to 100 alphanumeric characters	DI source Point name
Source Point 1	First of two digital input source points selected from the Point Picker to comprise the 4 state point being monitored for alarms. Based on user configured DI point name prefixed with system assigned identifier.	Not editable	System assigned identifier
Source Point 2	Second of two digital input source points selected to comprise the 4 state point being monitored for alarms.	List of points based on configured DIs.	N/A
Alarm Group	Single alarm group to which the point's alarm is to be associated with. All configuration information for the alarm group (e.g. color and sound settings) is applied to every point associated with the alarm group.	1 to 4	N/A
Transient Suppression Delay	Delay (in milliseconds) after which if an alarm is still in a transient state (State 00 or State 11), that an alarm is generated. This setting does not apply to alarms on the State 01 and State 10.	0 to 65535	0
Alarmable State	See Table 118.		
Text State	See Table 119.		

**Table 118 Alarmable State Settings**

Setting	Description	Range	Default
State 00 in Transit	Type of alarm that is generated when both Alarm Point 1 and Alarm Point 2 are in state 0 (typically Normal). Used with Alarmable State 11 to configure an On Update alarm, representing the transient states of a dual-point.	None Absolute On Update	None
State 01 Open	Type of alarm that is generated when Alarm Point 1 is in state 0 and Alarm Point 2 is in state 1 (typically alarmable). Typically used to configure an Absolute alarm to record a breaker being open.	None Absolute On Update	None

Setting	Description	Range	Default
State 10 Closed	Type of alarm that is generated when Alarm Point 1 is in state 1 and Alarm Point 2 is in state 0 (typically Normal).	None Absolute On Update	None
State 11 Invalid	Text to display to represent the point state when both Alarm Point 1 and Alarm Point 2 are in state 1 (typically alarmable). Used with Alarmable State 00 to configure an On Update alarm, representing the transient states of a dual-point.	None Absolute On Update	None

Table 119 Text State Settings

Setting	Description	Range	Default
Text State 00	Text to display to represent the point state when both Alarm Point 1 and Alarm Point 2 are in state 0, typically the Normal state. Typically set to "InTransit".	1 to 32 alphanumeric characters	00
Text State 01	Text to display to represent the point state when Alarm Point 1 is in state 0 and Alarm Point 2 is in state 1, typically the Alarm state. Typically set to "Open".	1 to 32 alphanumeric characters	01
Text State 10	Text to display to represent the point state when Alarm Point 1 is in state 1 and Alarm Point 2 is in state 0, typically the Normal state. Typically set to "Closed".	1 to 32 alphanumeric characters	10
Text State 11	Text to display to represent the point state when both Alarm Point 1 and Alarm Point 2 are in state 1, typically the Alarm state. Typically set to "Invalid".	1 to 32 alphanumeric characters	11

## Alarm Group Configuration

The Annunciator supports the configuration of five alarm groups: Group1, Group2, Group3, Group4 and System5. When you configure an alarm, you select to which group the alarm belongs.

The System alarm comprises the "Buffer Overflow" alarm, which is raised when the alarm buffer has reached its configured maximum size and started either deleting old records or rejecting new ones, based on the configured behavior. See "Maximum Number of Alarms" in Table 122.

## » To configure alarm groups

- On the **Alarm Configuration** tab, select a group under **Alarm Groups** and configure the attributes, including the alarm information columns to display on the Active Alarms page.

Settings are available on the **Alarm Configuration** tab. The D400 provides the alarm group settings as listed in Table 120.



Figure 14 Alarm Group Configuration Page

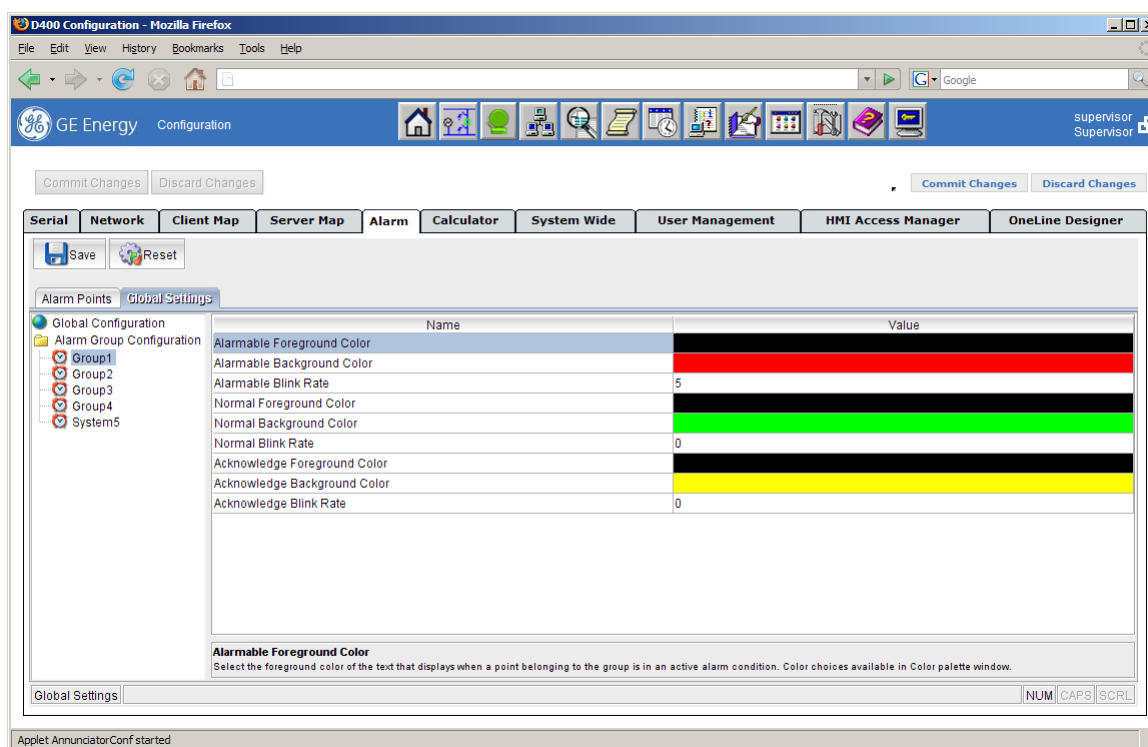


Table 120 Alarm Group Settings

Setting	Description	Range	Default
Group Name	Default group name of the selected alarm group.	Not editable.	As selected.
Alarmable Foreground Color	Foreground color (Red Green Blue) to be displayed in alarm text when an alarm from a point belonging to this group becomes active.	See Table 121 for options	Black
Alarmable Background Color	Background color (Red Green Blue) to be displayed in alarm text when an alarm belonging to this group becomes active.	See Table 121 for options	Red
Alarmable Blink Rate	Rate (in one tenths of a second) at which the active alarm text blinks. <i>Value    Rate/Second</i> 0        Blinking does not occur. 1        1/10th or 10 times per second 2        2/10th or 5 times per second 20      20/10th or 1 per 2 seconds	0 to 100	0
Normal Foreground Color	Foreground color (Red Green Blue) to be displayed in alarm text when an alarm belonging to this group becomes normal.	See Table 121 for options	Black
Normal Background Color	Background color (Red Green Blue) to be displayed in alarm text when an alarm belonging to this group becomes normal.	See Table 121 for options	Green

Setting	Description	Range	Default
Normal Blink Rate	Rate (in one tenths of a second) at which the normal alarm text of alarms belonging to this group blinks. <i>Value    Rate/Second</i> 0        Blinking does not occur. 1        1/10th or 10 times per second 2        2/10th or 5 times per second 20       20/10th or 1 per 2 seconds	0 to 100	0
Acknowledge Foreground Color	Foreground color (Red Green Blue) to be displayed in alarm text when an alarm belonging to this group becomes acknowledged.	See Table 121 for options	Black
Acknowledge Background Color	Background color (Red Green Blue) to be displayed in alarm text when an alarm belonging to this group becomes acknowledged.	See Table 121 for options	White
Acknowledge Blink Rate	Rate (in one tenths of a second) at which the alarm text of alarms belonging to this group blink when acknowledged. <i>Value    Rate/Second</i> 0        Blinking does not occur. 1        1/10th or 10 times per second 2        2/10th or 5 times per second 20       20/10th or 1 per 2 seconds	0 to 100	0

All foreground and background colors are in 24-bit, RGB format and can be selected and modified using the **Swatches**, **HSB** or **RGB** color palettes (see Figure 15.) Table 121 lists the available color palettes for each **Foreground Color** and **Background Color** setting for each alarm groups on the **Alarm Configuration** page.

Figure 15 Color Palette Window

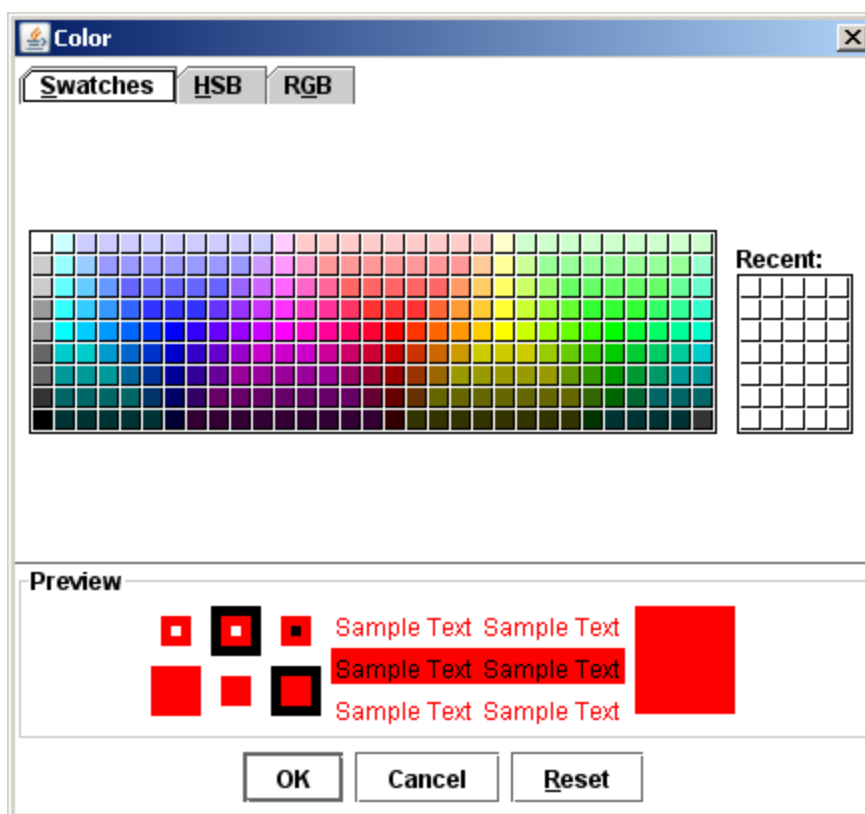


Table 121 Alarm Color Palettes

Color Palette	Description
Swatches	Select individual colors from a default RGB palette.
HSB (Hue Saturation Brightness)	Adjust H-Hue S-Saturation and B-Brightness levels. Hue adjusts the mix of Red, Green and Blue values.
RGB (Red Green Blue)	Adjust Red, Green and Blue values on the scale to a maximum of 255 each.

## Global Settings

### » To configure global settings

- On the **Alarm Configuration** tab, select **Global Configuration** and configure the settings.  
Settings are available on the **Alarm Configuration** tab. The D400 provides the global settings as listed in Table 122.

**Table 122 Alarm Global Settings**

Setting	Description	Range	Default
Maximum Number of Alarms	Maximum number of alarms (both active <i>and</i> historical) that can be present on the Active Alarms and Historical Alarms pages.	1 to 25000	10000
Buffer Overflow Deletion Method	Whether to delete oldest alarms or reject incoming alarms when the maximum number of alarms is reached.	Overwrite oldest alarms Reject new alarms	Overwrite oldest alarms
User Email Notification Delay	Time to wait (in seconds) to buffer alarm email messages before sending all of them as a single email to all configured email users. A setting of zero disables this feature - it does not result in instantaneous sending.	0 to 3600	30
Buffer Flush Rate	Inactivity period (in 1 second increments) after which the latest alarm updates to the database are written to the CompactFlash disk. Saves on CPU usage by buffering the latest alarm updates internally, and then flushing them when the buffer reaches the "flush now" level, or the flush time period expires.	10 to 100	30
Alarm Sound File	Sound file to play when an alarm belonging to this group becomes active on the Active Alarms page. Supported formats are: AIFF, AU, or WAV.	None List of available sound files	None
Alarm Blinking Rate	The rate, in one-tenths of a second, at which the alarm text blinks at. Enter 0 to disable blinking.	0 to 65535	5
Alarmable Image	Image to display on the Active Alarms button when active alarms are present.	None List of available image files	None
Acknowledge Image	Image to display on the Active Alarms button when acknowledged alarms are present	None List of available image files	None

---

## 6.3 Calculator

The Calculator application is typically used in the D400 to carry out the following functions:

- Provide the digital output point for the Global Controls Disable functionality
- Perform Mathematical, Logical, or Timer based operations on selected system data points
- Automatically operate one or more digital or analog outputs when certain conditions are met

The Calculator creates new points in the D400 system point database based on the results of configured expressions. All Calculator-owned points are referred to in the expressions by a configurable alias name. The values of the data points generated by the Calculator are evaluated each time a change event is received on one of the data points referenced in a defined expression.

The following data types are supported for use in expressions.

- Analog Input (AI)
- Digital (binary) Input (DI)
- Analog Output (AO)
- Digital (binary) Output (DO)
- Accumulators
- Text

The Calculator supports the following types of point calculations:

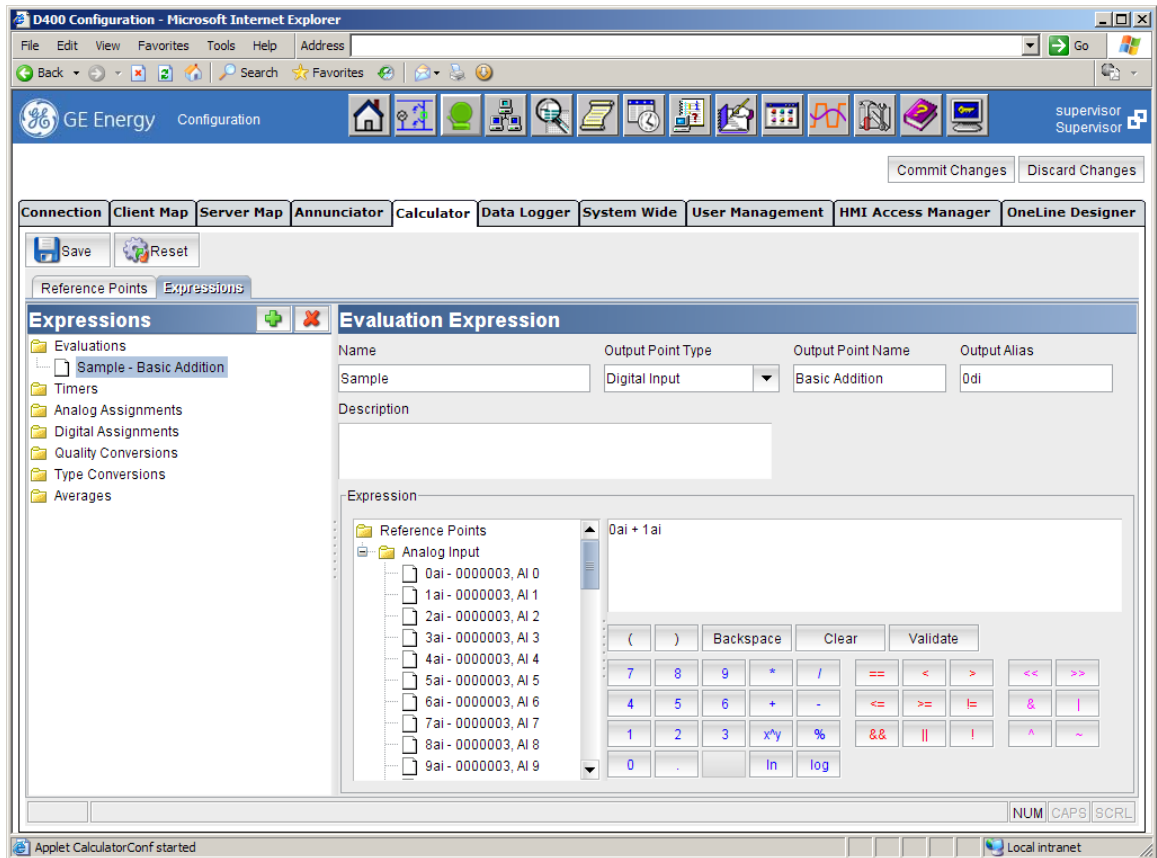
- Quality conversion
- Type conversion
- Evaluation/timer expressions
- Assignment expressions

Once you have defined calculated points, they are available for selection when creating client and server maps, and configuring alarms. During runtime, calculated point values are presented to the operator on the **Automation** tab on the **Point Details** page.

### Creating Calculated Points

You create calculated points on the **Calculator** tab on the **Configuration** page. Refer to the Online Help for additional information.

Figure 16 Calculator Page



### Calculator Expressions

The Calculator creates and updates new data points in the D400 based on user-configured expressions. You construct expressions by combining operands and operators to produce a resulting point.

Operands can include constants, system data points and Quality attributes. Operators include mathematical, logical, and bit-wise operators. The expressions also define the Point Names and Data Types that are used to represent the resulting evaluation.

## 6.4 LogicLinx (optional)

The D400 supports soft-logic automation using LogicLinx. The ConfigPro CCE LogicLinx Wizard was specifically developed to assist in the configuration of LogicLinx on the D400.

For information on how to configure LogicLinx on the D400, refer the *LogicLinx on D400 Quick Start Guide* (SWM0069).

## 6.5 D400 Redundancy Manager

The D400 Redundancy Manager is responsible for managing communications between the two D400 units and the RS232 switch panel. It also controls synchronization of quality and non-pseudo accumulator point data.

### Operational States

The D400 Redundancy Manager supervises the operational state and state transitions of the D400 units. The following states are possible:

**Table 123 D400 Redundancy Manager Operational States**

State	Description
Active	The unit is active and performing all the standard functions of a D400.
Standby	The unit is connected to another D400 unit that is in active mode, and is ready to assume active mode in the event of a failure of the other D400 unit or a manual change over request.
Non-redundant	The D400 is placed in this mode when redundancy is disabled through the <i>d400cfg</i> utility or when a configuration error is detected. In this state, the D400 ignores the RS232 switch panel and the other D400 unit. All redundancy related system points and functions are disabled.
Failed	The D400 has entered an unrecoverable state and all software functions have been suspended. The unit must be serviced or restarted to restore functionality.
Service	During service mode, D400 units do not accept change over requests. This mode is used to allow time for the D400 to re-initialize following a restart or system configuration change.

### System Points

When running in active mode, the application provides indications through the following digital input system points:

**Table 124 D400 Redundancy Manager Digital Input Points**

Point Name	Description
SystemRedundant	TRUE if the D400 is configured to be redundant FALSE if the D400 is not redundant
StandbyD400CommFail	TRUE if communications with the redundant D400 unit have failed; FALSE if not OFFLINE if the D400 is in non-redundant mode
StandbyD400inServiceMode	TRUE if the standby D400 is in service mode; FALSE if not OFFLINE if the D400 is in non-redundant mode
StandbyD400NotAvailable	TRUE if the standby D400 is in failed mode; False if not OFFLINE if the D400 is in non-redundant mode

Point Name	Description
D400AActive	TRUE if the D400 has been designated as unit "A" (See note) OFFLINE if the D400 is in non-redundant mode
D400BActive	TRUE if the D400 has been designated as unit "B" OFFLINE if the D400 is in non-redundant mode
Config Sync in Progress	TRUE if configuration synchronization is currently in progress; FALSE if not. OFFLINE if the D400 is in non-redundant mode.
Standby Config Out of Sync	TRUE if the configurations on the active and standby D400s do not match; FALSE if they do match. OFFLINE if the D400 is in non-redundant mode.

**Note:** The D400 is designated as unit A or B depending on the input block it is wired to on the RS232 switch panel.

You may issue Local Force or Alarm Inhibit commands on these points. All other commands will be rejected.

In addition to these indications, the following control points are available as digital outputs:

**Table 125 D400 Redundancy Manager Digital Output Points**

Point Name	Description
StartChangeOver	Triggers a change over – the active D400 moves to standby mode while the standby D400 takes over the active mode. If you are logged into the online GUI of the active D400 when a changeover occurs, the browser window closes and you are required to log in again. OFFLINE if the D400 is in non-redundant mode.
RestartActive	Requests a restart of all software on the active D400.
RestartStandby	Requests a restart of all software on the standby D400. OFFLINE if the D400 is in non-redundant mode.
RebootActive	Requests a reboot of the active D400.
RebootStandby	Requests a reboot of the standby D400. OFFLINE if the D400 is in non-redundant mode.
SyncConfig	Requests that the configuration of the standby D400 be synchronized with that of the active unit. OFFLINE if the D400 is in non-redundant mode.

You may issue any control operation on these points to initiate the request associated with the point. Upon receiving a control operation, the Redundancy Manager will momentarily pulse the state of the digital output to ON then OFF.

All local commands other than Control Inhibit will be rejected.



# 7

## Creating One-Line Diagrams

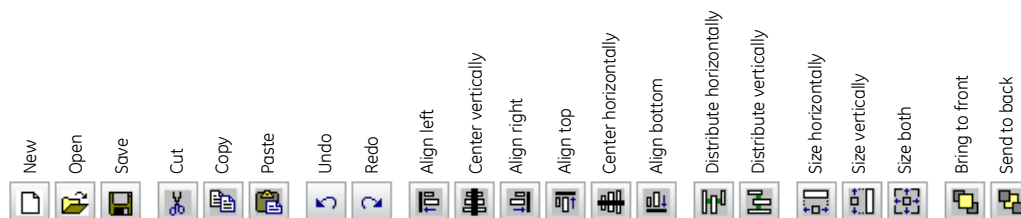
The One-Line Designer is a tool that enables you to create specialized diagrams and forms, customized to your substation environment and viewable via the **One-Line Viewer**.

In addition to creating a diagram or schematic of your network, you can display real time readouts of the values of selected ports and points.

### 7.1 Drawing Overview


#### Standard Toolbar

The standard toolbar provides tools to save and open diagrams, modify the placement of objects, and change the way the Drawing Area is shown.




If you forget a button's meaning, hover the mouse pointer over the button and a short description of the button's function is provided in the upper right of the display. A shortcut key combination is also shown that you can use to invoke the command.

## Save

As with any application, it is imperative that you save your data in a regular and ongoing fashion. Click the **Save** button  and enter a file name. Please note that the filename must be limited to a maximum of eight alphanumeric characters, followed by a dot and up to three additional alphanumeric characters. Once the filename is entered, click on the **OK** button.

**Note:** If you want the drawing to be the default diagram (the one that is loaded when you use the One Line Viewer), then the filename must be *main.dra*.

## Open




Use the **Open** button  to retrieve and edit any drawing that has been previously saved. Select the desired file name from the list and click the **OK** button.

## Repositioning

Repositioning requires no toolbar button. Select an item, hold down the left mouse button while the cursor is positioned anywhere inside the object, and drag it to the desired location.

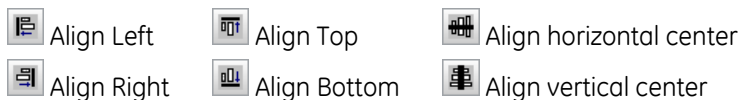
## Resizing

To resize an object, select the item, with the Select tool. Position the mouse cursor on any of the eight mini-boxes, hold down the left mouse button and drag the object to increase or decrease the size.



Objects may also be resized together and in relationship to each other. After selecting the multiple objects, three choices are available on the toolbar to resize the objects so they are the same size on the horizontal plane , the vertical plane , or both planes simultaneously . The last item selected is the controlling element. This means all chosen objects are resized to match the *last* object you have selected while holding down the **<CTRL>** key and clicking the mouse button.

## Alignment



Multiple objects may be aligned so that any of their four edges or two axes are in alignment and level along the grid no matter what their size. Buttons for each of the four edges and two axes are provided on the upper toolbar.



## Distribution

Multiple objects may be distributed horizontally or vertically. For horizontal distribution , the selected objects that are furthest to the left and right remain in place while the remaining selected objects are distributed evenly based on their centers. For vertical distribution , the top and bottom selected objects remain in place while the remaining selected objects are distributed evenly based on their centers.

## Establishing Order

Objects may be placed one on top of another in a layered configuration. A rectangle, for example, can be placed over a line. To control the layer order of objects, select an object, and choose to bring that element to the front  or send it to the back .

## 7.2 Types of Objects

All of the object types you can use to create your diagram are displayed on the drawing toolbar.

### Drawing Toolbar



**Select:** As you add individual objects to the canvas, they are treated as separate and distinct entities. After an object has been created, you may wish to return to the object in order to change its size, position, properties or appearance. Clicking the Select tool, then clicking the mouse on the object makes that object the active object, able to be manipulated or altered by the user. A user may confirm that the object is selected by observing a series of eight (8) boxes, located one to each corner and one to the middle of each edge—a standard *Windows* symbols to highlight selected objects.

**Note:** Even in the case of rounded objects, such as circles, the highlight boxes are in a square configuration. Since a line is one-dimensional, there is space only for two highlight boxes, one on each end of the chosen line.



**Text Box:** The Text Box tool allows you to create a box designed specifically to insert text. In the One Line Designer, the user first creates the box; text is added or altered by using the Properties display located on the right side of the screen. Clicking into the Values entry labeled Caption allows the user to enter the desired text. Other properties that may be changed include the alignment of the text inside the box (limited to left-aligned or centered), the color of the text (ForeColor), the box's background color (BackColor) and the box's border color. Double-clicking in the Font value offers the user a separate dialog box that includes the ability to change both the font type and size.

The Text Box tool, as well as other tools described below, also contains the capability to link to another drawing created by the One-Line Designer and stored on the D400. In the **Properties Values** box, click the mouse into the value column associated with the URL Anchor choice. To link to another drawing, type in the correct file name (note that all One-Line Designer files are saved with a dot extension of `.dra`, which must be typed as part of the filename). Likewise, to link to a web page, type in the full web address [such as <http://www.ge.com>]. In this manner you may actually create complex interlinked drawings. This enables someone viewing a particular file to go to a different diagram that may provide further detail. Should a user want to know more readings associated with a particular device, clicking on that device image launches him or her into another diagram that has been created to provide such magnified detail.



**Line:** Use this tool to create a one-dimensional line. The properties associated with this object allow you to alter the type of line (dotted or bold) and whether arrowheads are included at either the start or end of the line (but not on both ends).



**Rectangle:** This tool allows you to create a four-sided box of any size. You can modify the color of the border and the fill, the border type and thickness, and the URL Anchor for linking to another drawing.



**Ellipse:** This tool allows you to create a round object of any dimension. You can modify the color of the border and the fill, the border type and thickness, and the URL Anchor for linking to another drawing.



**Image:** This tool allows you to place an image on the drawing area, such as a scanned image of a piece of equipment or another specialized element not provided for in the default object types. When an image object is initially added, the image field is empty. To assign an image, double-click the value box for the property labeled Image File. A list of all images contained in the D400's `conf\htdocs\images` directory is presented. Select the desired Image File and click OK. As with the rectangle and ellipse object types, the border color and type may be changed, as well as the URL Anchor for linking to another drawing. Additionally, the image may be rotated 90 or 180 degrees.



**Value Box:** This is a central element in the development of dynamic diagrams. The Value Box can contain any device value that is being polled by the D400. After creating the Value Box, enter the device name into the Properties Values text box. You can do this by double-clicking into the appropriate value column. This action reveals a floating menu listing all available devices. You may also choose to manually type this information into the box, in which case the format for this entry must include the port number (preceded by the letter P) and the unit ID number, with a zero (0) separating the two numbers. The format is **Pn0xx**, where **n** is the port number and **xx** is the Unit ID number. Likewise, the specific PointName is entered in the appropriate Properties Values column; double-clicking in the Values column offers a similar "floating menu," from which the PointName may be selected. In the One Line Designer, the combined device name and PointName are shown. However, when this diagram is viewed with the One Line Viewer, the actual value targeted by this designator is what appears in the Value Box. Font elements and color choices are available for customization. The HttpPort value is presently reserved for future implementation.



**CB Box:** The CBBBox object is designed to schematically represent a power system circuit breaker. The CBBBox object accepts status inputs from 2 digital points (BitStrings). You can program the fill-colors of the breaker object, by setting colors to the following properties:

- FT\_Color
- FF\_Color
- TT\_Color
- TF\_Color

Based on the logic levels of the Digital Points selected, the fill color of the CBBBox will change appropriately in the Run\_Mode.

In the design mode, you can set the properties of Value1 and Value2 to 0 or 1 and verify that the fill color settings are satisfactory. Additionally, several values unique to Circuit Breaker Box operation are required.

You can designate the color values for the object dependent on what the Target Value is and whether or not it is returned. Two appropriate points should be identified. These two Points may come from two different devices or can come from same device and are entered into the appropriate Property Value lines for IEDName and the PointName. Again, double-clicking into the appropriate corresponding Value offers the “floating menu” choices. Properties for HttpPort, CmdHttpPort, CmdIEDName and CmdPointName are not being used currently and are reserved for future implementation.

To assign input points to the CB-Box object, you would invoke the Tag Picker interface as described below:

- Double Click on the property area of IEDName1.
- Select a device from the Select IED dialog.
- Double Click on the property area of PointName1.
- Select a BitString point from the Select Point dialog.
- Repeat Steps above for the IEDName2, and PointName2

The next step is to choose the desired bits out of the BitString you just selected. The bit strings are treated as a 0 based array of digital status points. The BitPosition1, and BitPosition2 properties accept input in x.y format.

Where  $x$  = index of the desired status point in the BitString and where  $y$  = length of the BitString. This should always be 1 for the D400



**Transformer:** This object is a basic graphic representation of a transformer and has the same Property Value characteristics as a standard rectangle (except for the fill choice), including border color and type, and rotation. The URL Anchor is also available for linking to another drawing.



**Ground:** This object offers graphical representation of a ground and is limited to the same Property Value characteristics as a standard line, including border color and type. The URL Anchor is also available for linking to another drawing.



**Switch:** This object represents a switch in the substation configuration. As such, it has Property Values that can be drawn from existing equipment, assuming that there is a device polling this information. You must assign the appropriate IEDname and the PointName for the switch. You also need to identify the correct Property Value for when the switch is closed (0 or 1), and apply the opposite value for the open position; note that the graphic configuration changes its appearance relative to the switch's condition. Properties for HttpPort, CmdHttpPort, CmdIEDName and CmdPointName are not being used currently and are reserved for future implementation. The basic graphic Property Values seen in other objects, including line width and color, border color and type, and background color, can also be assigned in the appropriate Values boxes.

## 7.3 Object Configuration Settings

### Property Panel

The Property Panel displays the properties associated with the currently selected object. Based on the type of object selected, the properties window will show different options.

**Table 126 Accumulator Status Object Settings**

Setting	Description	Range	Default
Point Identifier	A point identifier for a single accumulator point, where the identifier consists of the device name and point descriptor	Existing accumulator point identifier	None
Accumulator Type	Whether to monitor status on frozen or running value	One of Frozen or Running	None

**Table 127 Alarm Object Settings**

Setting	Description	Range	Default
Point Identifier	A point identifier for a single alarm indicator point, where the identifier consists of the alarm indicator point descriptor	Existing alarm indicator point identifier	None

**Table 128 Alarm Box Object Settings**

Setting	Description	Range	Default
Alarm Object Identifier	Unique identifier for an Alarm Object that provides the data source required for the Alarm Box	Existing Alarm Object identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Font Type	The type of font used to display text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display text	1 to 100	11
Font Style	The font style to apply to the display of text	One of normal, bold, or italic	Normal

Setting	Description	Range	Default
Foreground Color	The color to apply to text	Any 24 bit RGB color	Black
Text Horizontal Alignment	The horizontal alignment of the text within the object's display area	One of Left, Center, or Right	Left
Text Vertical Alignment	The vertical alignment of the text within the object's display area	One of Bottom or Top	Bottom
Alarm Behavior	Defines blinking display characteristics of the alarm box	One of Blink Text or Blink Border	Blink Border
Normal State Text	Defines the text to display in the Alarm Box when its corresponding Alarm is in normal state	Text	None
Alarm State Text	Defines the text to display in the Alarm Box when its corresponding Alarm is in alarm state	Text	None
Normal Background Color	Defines the background color to display in the Alarm Box when its corresponding Alarm is in normal state	Any 24 bit RGB color	Green
Alarm Background Color	Defines the background color to display in the Alarm Box when its corresponding Alarm is in alarm state	Any 24 bit RGB color	Red
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB color	Black
Border Type	Defines the type of border to display	0 to 255	0
Border Width	Defines the pixel width of the border	1 to 7	4
Acknowledgement Action	Defines the user mouse action required to acknowledge an alarm box	One of Single Left Click, Double Left Click, or No Mouse Click	Double Left Click

Table 129 Analog Set Point Object Settings

Setting	Description	Range	Default
Point Identifier	A point identifier for a single analog output point on which to operate a set point command, where the identifier consists of the device name and point descriptor	Existing analog output point identifier	None
Minimum Value	Minimum permitted set point value	Any 64 bit floating point value	0
Maximum Value	Maximum permitted set point value	Any 64 bit floating point value	0
Function Code	The type of protocol request to send as part of the set point command	One of Direct Operate, or Direct Operate with No Acknowledgement	Direct Operate

Setting	Description	Range	Default
Enable Feedback	Whether or not to enable a feedback analog input point to receive status on a set point command <b>Note:</b> In a distributed system, the only reliable way to determine the success of a control operation is through a hardwired digital input or analog input point providing the feedback of the process state being controlled.	True or False	False
Feedback Point Identifier	If Enable Feedback is True: a point identifier for a single analog input point on which to receive the feedback value in response to a set point command, where the identifier consists of the device name and point descriptor	Existing analog input point identifier	None
Timeout	If Enable Feedback is True: the timeout period (in seconds) during which the feedback point value must change to correspond to the set point value to indicate successful completion of the set point command. A value of 0 shall indicate there is no timeout.	0 to 65535	10
Deadband Threshold Percentage	If Enable Feedback is True: the feedback value maximum percentage variation from the set point value by which the feedback value shall still be considered to be equal to the set point value.	0 to 100	5
Confirmation Required	Defines whether the GUI is to display a confirmation dialog immediately prior to executing a set point	True or False	True

Table 130 Analog Status Object Settings

Setting	Description	Range	Default
Point Identifier	A point identifier for a single analog input, where the identifier consists of the device name and analog input point descriptor	Existing analog input point identifier	None
Deadband Threshold Percentage	The percentage variation from the last value that exceeded deadband, which once exceeded becomes reported, and becomes the new last value for future reporting	0 to 100	5

Table 131 Button Object Settings

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0



Setting	Description	Range	Default
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	20
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Font Type	The type of font used to display text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display text	1 to 100	11
Font Style	The font style to apply to the display of text	One of normal, bold, or italic	Normal
Foreground Color	The color to apply to text	Any 24 bit RGB Color	Black
Background Color	The color to apply to the background	Any 24 bit RGB Color	Grey
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Caption	Text for the object to display	Text	Button
Action Type	Defines the action to occur when the user selects the button	One of "Open Analog Set Point Interface", "Open Digital Control Interface", "Open Raise/Lower Control Interface", "User Specified URL in Same Window", "User Specified URL in New Window"	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load for actions of type "User Specified URL in Same Window" or "User Specified URL in New Window".	Any valid URL address	None

Setting	Description	Range	Default
Object Identifier	<p>If Action Type is "Open Analog Set Point Interface", object identifier must belong to an Analog Set Point Object.</p> <p>If Action Type is "Open Digital Control Interface", object identifier must belong to a Digital Control Object.</p> <p>If Action Type is "Open Raise/Lower Control Interface", object identifier must belong to a Raise/Lower Control Object.</p> <p>Otherwise Object Identifier shall be empty</p>	Object Identifier	None

**Table 132 Capacitor Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Rotation	Angle of clockwise rotation (in degrees) to apply to the image	0,90,180,270	0
File Path	File path of alternate (non-default) image to display	Any existing server side image file	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 133 Circuit Breaker Box Object Settings**

Setting	Description	Range	Default
Object Identifier	Object Identifier of a four state Digital Status Object, or of a Digital Control Object (configured with four state feedback status)	Existing Digital Status or Digital Control Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Digital Input Value 1 True State	Digital input 1 value to associate with a “true” state	0 or 1	1
Digital Input Value 2 True State	Digital input 2 value to associate with a “true” state	0 or 1	1
TT Color	The background color to display when the digital input 1 value (low bit) corresponds to the true state, and the digital input 2 value (high bit) corresponds to the true state.	Any 24 bit RGB Color	Red
TF Color	The background color to display when the digital input 1 value (low bit) corresponds to the false state, and the digital input 2 value (high bit) corresponds to the true state.	Any 24 bit RGB Color	Red
FT Color	The background color to display when the digital input 1 value (low bit) corresponds to the true state, and the digital input 2 value (high bit) corresponds to the false state.	Any 24 bit RGB Color	Red
FF Color	The background color to display when the digital input 1 value (low bit) corresponds to the false state, and the digital input 2 value (high bit) corresponds to the false state.	Any 24 bit RGB Color	Red

**Table 134 Digital Control Object Settings**

Setting	Description	Range	Default
Primary Output Point Identifier	Point identifier of a digital output point where the identifier consists of the device name and point descriptor	Existing digital output point identifier	None
Function Code	The protocol function code to pass as part of the digital control command sent to a device.	One of Direct Operate, Direct Operate with No Acknowledgement, Select Before Operate, Select, Operate	None
Primary Pulse On Time	Primary control pulse on time in milliseconds (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close)	0 to 65535	0
Primary Pulse Off Time	Primary control pulse off time in milliseconds (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close)	0 to 65535	0
On State Control Code	Protocol control code to send as part of the digital control command, when the user requests to send an On state.	One of Latch On, Latch Off, Pulse On, Pulse Off, Trip, or Close	None
Off State Control Code	Protocol control code to send as part of the digital control command, when the user requests to send an Off state.	One of Latch On, Latch Off, Pulse On, Pulse Off, Trip, or Close	None
On State Control Text	The user defined text used to describe the operation to turn the digital control to “on”	Any text	Textual representation of the configured control code
Off State Control Text	The user defined text used to describe the operation to turn the digital control to “off”	Any text	Textual representation of the configured control code
Repeat Count	Number of times to consecutively repeat a control code, applying the pulse on and pulse off times to each control pulse repetition (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close). A value of 1 means to issue the control code once (e.g. no repetition)	1 to 255	1

Setting	Description	Range	Default
Secondary Output Enabled	Whether to enable a secondary output point or not. When a primary output exists but a secondary is not enabled, an on and off control state are both associated with the primary output point. Setting a control state to on or off has the result of executing the configured control code on the primary output point. When a primary output and a secondary output is enabled, then the on control state must be assigned to only one of them, and the off control state must be assigned to the other output. Setting a control state to on or off in this case has the result of executing the configured control code on either the primary or secondary output point, but never both.	True or False	False
Secondary Output Point Identifier	If Secondary Output Enabled set to True: point identifier of a digital output point where the identifier consists of the device name and point descriptor	Existing digital output point identifier	None
Secondary Pulse On Time	If Secondary Output Enabled set to True: secondary control pulse on time in milliseconds (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close)	0 to 65535	0
Secondary Pulse Off Time	If Secondary Output Enabled set to True: secondary control pulse off time in milliseconds (applies only to Control Codes of type Pulse On, Pulse Off, Trip, or Close)	0 to 65535	0
Secondary Control State	If Secondary Output Enabled set to True: whether to associate the secondary output point with the On State or Off State. The primary output point will be associated with whichever state the secondary is not associated with.	On or Off	Off
Feedback Enabled	Whether or not to enable feedback status. <b>Note:</b> In a distributed system, the only reliable way to determine the success of a control operation is through a hardwired digital input or analog input point providing the feedback of the process state being controlled.	True or False	False
Feedback Size	If Feedback Enabled set to True: whether to utilize 2 state feedback or 4 state feedback	2 State or 4 State	None
Primary Feedback Point Identifier	If Feedback Enabled set to True: point identifier for a single two state feedback point consisting of a single digital input point, or of the first of two digital input points required to represent four state status, where the identifier consists of the device name and point descriptor	Existing digital input point identifier	None

Setting	Description	Range	Default
Secondary Feedback Point Identifier	If Feedback Enabled set to True, and Feedback Size set to 4 State: point identifier for the second of two digital input points required to represent four state status, where the identifier consists of the device name and point descriptor	Existing digital input point identifier	None
Timeout	If Feedback Enabled set to True: The timeout period after which a digital control is executed that the feedback state must change to correspond to the digital control state. If the digital control state does not correspond within the timeout period, the control shall be aborted. A value of 0 indicates no timeout.	0 to 65535	10
State 0 Text	If Feedback Enabled set to True, and Feedback Size set to 2, the user defined text used to represent a 2 state feedback value of 0.	Any text	Empty
State 1 Text	If Feedback Enabled set to True, and Feedback Size set to 2, the user defined text used to represent a 2 state feedback value of 0.	Any text	Empty
State 00 Text	If Feedback Enabled set to True, and Feedback Size set to 4, the user defined text used to represent a 4 state feedback value of 00.	Any text	Empty
State 01 Text	If Feedback Enabled set to True, and Feedback Size set to 4, the user defined text used to represent a 4 state feedback value of 01.	Any text	Empty
State 10 Text	If Feedback Enabled set to True, and Feedback Size set to 4, the user defined text used to represent a 4 state feedback value of 10.	Any text	Empty
State 11 Text	If Feedback Enabled set to True, and Feedback Size set to 4, the user defined text used to represent a 4 state feedback value of 11.	Any text	Empty
On Control State Feedback State	The feedback state required to occur in response to an On State sent to a control, in order for the control to be considered successful.	If 2 State, one of 0 or 1. If 4 State, one of 00, 01, 10, or 11.	None
Off Control State Feedback State	The feedback state required to occur in response to an On State sent to a control, in order for the control to be considered successful.	If 2 State, one of 0 or 1. If 4 State, one of 00, 01, 10, or 11.	None
Confirmation Required	Defines whether the GUI is to display a confirmation dialog immediately prior to executing a control	True or False	True

**Table 135 Digital Status Object Settings**

<b>Setting</b>	<b>Description</b>	<b>Range</b>	<b>Default</b>
Size	Whether to utilize 2 state status or 4 state status	2 State or 4 State	2 State
Primary Point Identifier	A point identifier for a single two state status point consisting of a single digital input point, or of the first of two digital input points required to represent four state status, where the identifier consists of the device name and point descriptor	Existing digital input point identifier	None
Secondary Point Identifier	If Size set to 4 State: point identifier for the second of two digital input points required to represent four state status, where the identifier consists of the device name and point descriptor	Existing digital input point identifier	None
State 0 Text	If Size set to 2, the user defined text used to represent a 2 state feedback value of 0.	Any text	Empty
State 1 Text	If Size set to 2, the user defined text used to represent a 2 state feedback value of 0.	Any text	Empty
State 00 Text	If Size set to 4, the user defined text used to represent a 4 state feedback value of 00.	Any text	Empty
State 01 Text	If Size set to 4, the user defined text used to represent a 4 state feedback value of 01.	Any text	Empty
State 10 Text	If Size set to 4, the user defined text used to represent a 4 state feedback value of 10.	Any text	Empty
State 11 Text	If Size set to 4, the user defined text used to represent a 4 state feedback value of 11.	Any text	Empty

**Table 136 Ellipse Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Background Color	The background color with which to fill the object	Any 24 bit RGB Color	Red
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None



**Table 137 Ground Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Rotation	Angle of clockwise rotation (in degrees) to apply to the image	0,90,180,270	0
File Path	File path of alternate (non-default) image to display	Any existing server side image file	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 138 Image Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Rotation	Angle of clockwise rotation (in degrees) to apply to the image	0,90,180,270	0
File Path	File path of image to display	Any existing server side image file	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 139 Label Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	20
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Font Type	The type of font used to display text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display text	1 to 100	11
Font Style	The font style to apply to the display of text	One of normal, bold, or italic	Normal
Foreground Color	The color to apply to text	Any 24 bit RGB Color	Black
Background Color	The color to apply to the background	Any 24 bit RGB Color	White
Caption	Text for the object to display	Text	Label
Text Horizontal Alignment	The horizontal alignment of the text within the object's display area	One of Left, Center, or Right	Left
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 140 Line Object Settings**

Setting	Description	Range	Default
X1	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the start point of the line	0 to the Draw Panel width	0
Y1	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the start point of the line	0 to the Draw Panel height	0
X2	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the end point of the line	0 to the Draw Panel width	0
Y2	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the end point of the line	0 to the Draw Panel height	0
Arrow Type	Defines the type of arrow head to apply to the line at the X1, Y2 position (start of line) and/or the X2, Y2 position (end of line)	One of No Arrow, Start Arrow, End Arrow, or Both Start and End Arrows	No Arrow
Line Type	Defines the type of line to draw	One of Solid, Dotted, or Dashed	Solid
Line Color	Defines the color to apply to the line	Any 24 bit RGB color	Black
Line Width	Defines the pixel width of the line	1 to 100	1

**Table 141 Raise/Lower Control Object Settings**

Setting	Description	Range	Default
Primary Output Point Identifier	Point identifier of a digital output point where the identifier consists of the device name and point descriptor	Existing digital output point identifier	None
Function Code	The protocol function code to pass as part of the digital control command sent to a device.	One of Direct Operate, Direct Operate with No Acknowledgement, Select Before Operate, Select, Operate	None
Primary Pulse On Time	Primary control pulse on time in milliseconds	0 to 65535	0
Primary Pulse Off Time	Primary control pulse off time in milliseconds	0 to 65535	0
Raise State Control Code	Protocol control code to send as part of the control command, when the user requests to send a Raise.	One of Pulse On, Pulse Off, Trip, or Close	None
Lower State Control Code	Protocol control code to send as part of the control command, when the user requests to send a Lower.	One of Pulse On, Pulse Off, Trip, or Close	None
Repeat Count	Number of times to consecutively repeat a control code, applying the pulse on and pulse off times to each control pulse repetition. A value of 1 means to issue the control code once (e.g. no repetition)	1 to 255	1
Secondary Output Enabled	Whether to enable a secondary output point or not. When a primary output exists but a secondary is not enabled, a raise and lower control state are both associated with the primary output point. Setting a control state to raise or lower has the result of executing the configured control code on the primary output point. When a primary output and a secondary output is enabled, then the raise control state must be assigned to only one of them, and the lower control state must be assigned to the other output. Setting a control state to raise or lower in this case has the result of executing the configured control code on either the primary or secondary output point, but never both.	True or False	False
Secondary Output Point Identifier	If Secondary Output Enabled set to True: point identifier of a digital output point where the identifier consists of the device name and point descriptor	Existing digital output point identifier	None
Secondary Pulse On Time	If Secondary Output Enabled set to True: secondary control pulse on time in milliseconds	0 to 65535	0
Secondary Pulse Off Time	If Secondary Output Enabled set to True: secondary control pulse off time in milliseconds	0 to 65535	0

Setting	Description	Range	Default
Secondary Control State	If Secondary Output Enabled set to True: whether to associate the secondary output point with the Raise State or Lower State. The primary outpoint point will be associated with whichever state the secondary is not associated with.	On or Off	Off
Feedback Enabled	Whether or not to enable feedback status. <b>Note:</b> In a distributed system, the only reliable way to determine the success of a control operation is through a hardwired digital input or analog input point providing the feedback of the process state being controlled.	True or False	False
Analog Feedback Point	If Feedback Enabled set to True: point identifier for a single analog input point, where the identifier consists of the device name and point descriptor	Existing analog input point identifier	None

**Table 142 Range Aware Bar Chart Object Settings**

Setting	Description	Range	Default
Object Identifier	Object Identifier of an Analog Status or Accumulator Status object.	Existing Analog Status or Accumulator Status Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	80
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Font Type	The type of font used to display the scaling value as text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display the scaling value as text	1 to 100	11
Font Style	The font style to apply to the display of the scaling value as text	One of normal, bold, or italic	Normal
Foreground Color	The color to apply to scaling value displayed as text	Any 24 bit RGB Color	Black
Background Color	The color to apply to the background, non-highlighted area of the bar chart.	Any 24 bit RGB Color	Red
High Range Color	The color to apply to the highlighted area, but only when the real time value exceeds the configured High Range Value.	Any 24 bit RGB Color	Red
Low Range Color	The color to apply to the highlighted area, but only when the real time value is less than or equal to the configured High Range Value.	Any 24 bit RGB Color	Red
High Range Value	The value, which when exceeded by the real time value, shall result in the highlighted area of the bar chart being displayed in the High Range Color, and which when the real time value is less than or equal to, shall result in the highlighted area of the bar chart being displayed in the Low Range Color.	Any 24 bit RGB Color	Red

Setting	Description	Range	Default
Bar Scaling Value	The value by which the real time values are divided to calculate a full scale percentage that determines the height of the bar during run-time. The Bar Scaling Value determines the maximum run-time value that can be displayed in the bar chart.	Any 64 bit floating point value	1
Fill Direction	<p>Fill direction defines the manner in which the highlighted area shall be drawn:</p> <p>If set to bottom, the highlighted area shall rise vertically upwards, being filled from its bottom edge upwards ending at a horizontal line that corresponds to the percentage of the real time value as compared to the configured bar scaling value.</p> <p>If set to top, the highlighted area shall rise vertically downwards, being filled from its top edge downwards ending at a horizontal line that corresponds to the percentage of the real time value as compared to the configured bar scaling value.</p> <p>If set to left, the highlighted area shall rise horizontally to the right, being filled from its left edge to the right ending at a vertical line that corresponds to the percentage of the real time value as compared to the configured bar scaling value.</p> <p>If set to right, the highlighted area shall rise horizontally to the left, being filled from its right edge to the left ending at a vertical line that corresponds to the percentage of the real time value as compared to the configured bar scaling value.</p>	One of Top, Bottom, Left, or Right	Bottom
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None



**Table 143 Range Aware Line Object Settings**

Setting	Description	Range	Default
Object Identifier 1	Object Identifier of one of three Analog Status objects.	Existing Analog Status Object Identifier	None
Object Identifier 2	Object Identifier of one of three Analog Status objects.	Existing Analog Status Object Identifier	None
Object Identifier 3	Object Identifier of one of three Analog Status objects.	Existing Analog Status Object Identifier	None
X1	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the start point of the line	0 to the Draw Panel width	0
Y1	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the start point of the line	0 to the Draw Panel height	0
X2	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the end point of the line	0 to the Draw Panel width	0
Y2	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the end point of the line	0 to the Draw Panel height	0
Arrow Type	Defines the type of arrow head to apply to the line at the X1, Y2 position (start of line) and/or the X2, Y2 position (end of line)	One of No Arrow, Start Arrow, End Arrow, or Both Start and End Arrows	No Arrow
Line Type	Defines the type of line to draw	One of Solid, Dotted, or Dashed	Solid
Line Width	Defines the pixel width of the line	1 to 100	1
Very Low Range Value	The value, which when the real time value is lower, shall result in the line being drawn with the Very Low Range Line Color. Note that Very Low Range Value $\leq$ Low Range Value $<$ High Range Value $\leq$ Very High Range Value.	Any 64 bit floating point value	0
Low Range Value	The value, which when the real time value is lower, but higher than or equal to the Very Low Range Value, shall result in the line being drawn with the Low Range Line Color. Note that Very Low Range Value $\leq$ Low Range Value $<$ High Range Value $\leq$ Very High Range Value.	Any 64 bit floating point value	0

Setting	Description	Range	Default
High Range Value	The value, which when the real time value is the same or lower, but higher than or equal to the Low Range Value, shall result in the line being drawn with the Normal Line Color. Also, the value, which when the real time value is higher, but less than or equal to the Very High Range Value, shall result in the line being drawn with the High Line Color. Note that Very Low Range Value $\leq$ Low Range Value $<$ High Range Value $\leq$ Very High Range Value.	Any 64 bit floating point value	0
Very High Range Value	The value, which when the real time value is the higher, shall result in the line being drawn with the Very High Line Color. Note that Very Low Range Value $\leq$ Low Range Value $<$ High Range Value $\leq$ Very High Range Value.	Any 64 bit floating point value	0
Very Low Range Line Color	The color to apply to the line, but only when the summation of the three Analog Status values is less than or equal to the Very Low Range Value.	Any 24 bit RGB Color	Black
Low Range Line Color	The color to apply to the line, but only when the summation of the three Analog Status values exceeds the configured Very Low Range Value and is less than the Low Range Value.	Any 24 bit RGB Color	Black
Normal Range Line Color	The color to apply to the line, but only when the summation of the three Analog Status values is greater than or equal to the configured Low Range Value and is less than or equal to the High Range Value.	Any 24 bit RGB Color	Black
High Range Line Color	The color to apply to the line, but only when the summation of the three Analog Status values exceeds the configured High Range Value and is less than or equal to the Very High Range Value.	Any 24 bit RGB Color	Black
Very High Range Line Color	The color to apply to the line, but only when the summation of the three Analog Status values exceeds the configured Very High Range Value.	Any 24 bit RGB Color	Black

**Table 144 Range Aware Value Box Object Settings**

Setting	Description	Range	Default
Object Identifier	Object Identifier of an Analog Status or Accumulator Status object.	Existing Analog Status or Accumulator Status Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	20
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Font Type	The type of font used to display value as text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display value as text	1 to 100	11
Font Style	The font style to apply to the display of the value as text	One of normal, bold, or italic	Normal
Foreground Color	The color to apply to the value displayed as text	Any 24 bit RGB Color	Black
High Range Color	The color to apply to the background, but only when the real time value exceeds the configured High Range Value.	Any 24 bit RGB Color	Red
Mid Range Color	The color to apply to the background, but only when the real time value is greater than or equal to the configured Low Range Value, and is less than or equal to the configured High Range Value.	Any 24 bit RGB Color	Red
Low Range Color	The color to apply to the background, but only when the real time value is less than the configured Low Range Value.	Any 24 bit RGB Color	Red
Low Range Value	The value, which when the real time value is lower, shall result in the background being displayed with the Low Range Color.	Any 64 bit floating point value	0

Setting	Description	Range	Default
High Range Value	The value, which when the real time value is higher, shall result in the background being displayed with the High Range Color.	Any 64 bit floating point value	0
Text Horizontal Alignment	The horizontal alignment of the value displayed as text within the object's display area	One of Left, Center, or Right	Left

**Table 145 Reactor Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Rotation	Angle of clockwise rotation (in degrees) to apply to the image	0,90,180,270	0
File Path	File path of alternate (non-default) image to display	Any existing server side image file	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 146 Rectangle Object Settings**

Setting	Description	Range	Default
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	20
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Background Color	The background color with which to fill the object	Any 24 bit RGB Color	Red
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 147 Switch Object Settings**

Setting	Description	Range	Default
Object Identifier	Object Identifier of a four state Digital Status Object	Existing Digital Status Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	40
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Orientation	Whether to draw the switch state representations in a horizontal or vertical orientation	Horizontal or Vertical	Horizontal
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Line Color	Defines the color with which to draw the lines that comprise the switch display	Any 24 bit RGB Color	Black
Line Width	Line width in pixels	1 to 100	1
00 Switch State	If the Digital Status Object is a 4 State Digital: The switch state to display when the digital input 1 value (low bit) corresponds to the 0 state, and the digital input 2 value (high bit) corresponds to the 0 state.	One of Open, Closed, In Transit, or Invalid	None
01 Switch State	If the Digital Status Object is a 4 State Digital: The switch state to display when the digital input 1 value (low bit) corresponds to the 1 state, and the digital input 2 value (high bit) corresponds to the 0 state.	One of Open, Closed, In Transit, or Invalid	None
10 Switch State	If the Digital Status Object is a 4 State Digital: The switch state to display when the digital input 1 value (low bit) corresponds to the 0 state, and the digital input 2 value (high bit) corresponds to the 1 state.	One of Open, Closed, In Transit, or Invalid	None
11 Switch State	If the Digital Status Object is a 4 State Digital: The switch state to display when the digital input 1 value (low bit) corresponds to the 1 state, and the digital input 2 value (high bit) corresponds to the 1 state.	One of Open, Closed, In Transit, or Invalid	None
0 Switch State	If the Digital Status Object is a 2 State Digital: The switch state to display when the digital input value corresponds to the 0 state.	One of Open or Closed	None

Setting	Description	Range	Default
1 Switch State	If the Digital Status Object is a 2 State Digital: The switch state to display when the digital input value corresponds to the 1 state.	One of Open or Closed	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same
URL Address	Defines the web page to load when a user selects the object	Any valid URL address	None

**Table 148 Digital Status Object Settings**

Setting	Description	Range	Default
Point Identifier	A point identifier for a single RTDB text point, where the identifier consists of the device name and point descriptor	Existing text point identifier	None

**Table 149 Transformer Object Settings**

Setting	Description	Range	Default
Object Identifier	Optional Object Identifier of a Raise/Lower Control Object	Existing Raise/Lower Control Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	60
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	60
Orientation	Whether to draw the object transformer windings in a horizontal or vertical orientation	Horizontal or Vertical	Horizontal
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0

Setting	Description	Range	Default
Number of Windings	Defines the number of transformer windings to include in the object	2 or 3	2
Winding 1 Line Width	Line width of the first winding in pixels	1 to 100	1
Winding 1 Line Color	Line color of the first winding	Any 24 bit RGB Color	Black
Winding 2 Line Width	Line width of the second winding in pixels	1 to 100	1
Winding 2 Line Color	Line color of the second winding	Any 24 bit RGB Color	Black
Winding 3 Line Width	If Number of Windings are Configured as 3: Line width of the third winding in pixels	1 to 100	1
Winding 3 Line Color	If Number of Windings are Configured as 3: Line color of the third winding	Any 24 bit RGB Color	Black
Load Tap Changer Line Width	Line width of the load tap changer arrow	1 to 100	1
Load Tap Changer Line Color	Line color of the load tap changer arrow	Any 24 bit RGB Color	Black
Load Tap Changer Winding #	Defines which winding to draw the load tap changer arrow over top of (with 0 indicating to not draw a load tap changer arrow)	0, 1, 2, or 3	0
URL Address	Defines the web page to load when a user selects the transformer	Any valid URL address	None
URL Action	Specifies whether to load the URL Address into the same window, or a new window. An action to open a link in a different window shall require that the configured URL does not address a Main page or Power Bar Enabled page. An action to open a link in the same window shall require that the configured URL addresses a Power Bar Enabled page when the current page is also a Power Bar Enabled page.	Same or New	Same



Table 150 Value Box Object Settings

Setting	Description	Range	Default
Object Identifier	Object Identifier of an Analog Set Point, Analog Status, Accumulator Status, Digital Status, or Text object.	Existing Analog Set Point, Analog Status, Accumulator Status, or Digital Status Object Identifier	None
X	X (horizontal) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel width less the object width	0
Y	Y (vertical ) pixel position from the top left corner of the screen to the top left corner of the area used to display the object	0 to the Draw Panel height less the object height	0
Height	Pixel height of the rectangular area used to display the object	1 to the Draw Panel height	20
Width	Pixel width of the rectangular area used to display the object	1 to the Draw Panel width	40
Border Color	Defines the color to apply to the border around the perimeter of the display area of the object	Any 24 bit RGB Color	Black
Border Width	Defines the pixel width of the border	1 to 7	1
Border Type	Defines the type of border to display	0 to 255	0
Font Type	The type of font used to display value as text	One of SansSerif, Serif, Monospaced, DialogInput	SansSerif
Font Size	The size of the font used to display value as text	1 to 100	11
Font Style	The font style to apply to the display of the value as text	One of normal, bold, or italic	Normal
Foreground Color	The color to apply to the value displayed as text	Any 24 bit RGB Color	Black
Background Color	The color to apply to the background	Any 24 bit RGB Color	Red
Text Horizontal Alignment	The horizontal alignment of the value displayed as text within the object's display area	One of Left, Center, or Right	Left

# 8

## System Utilities

Configuration information related to the D400 system is changed using utility programs that are installed on the D400 platform.

The D400 system utilities are typically used during the initial setup of the D400 and for changing the basic configuration of the system, including the network connections, system date and time, and administrator passwords.

The utilities are intended for use by service personnel and application engineers responsible for setting up and maintaining the D400. Because of the advanced functionality, it is helpful to have basic knowledge of Telnet, ftp and Linux commands in order to execute the commands for your specific system setup.

This chapter covers how to use the various system utilities.

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### 8.1 Utilities Overview

The D400 includes the following utility programs:

- D400 Configuration
- D400 Connect
- I/O Traffic Display
- Printer
- Email Transfer
- Software licensing tools
- Emergency Access Code

These advanced D400 configuration and system administration functions are available at the D400 command line interface.

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## 8.2 Setting up a Terminal Session

You can access these system utilities directly at the D400 command prompt through the local maintenance port or remotely through the Utilities Power bar button in the D400 HMI. The Utilities page provides a TELNET or a Secure Shell (SSH) login to establish a remote terminal session with the D400.

Access to the command line interface requires an Administrator or root log in.

**Note:** When accessing the D400 with an Administrator-level user account, you may not have sufficient security privileges to execute the commands listed in this manual. If this occurs, type “**sudo**” in front of each command.

Refer to the *D400 Substation Data Manager User's Manual* (994-0089) for instructions on how to access the D400's command line interface.

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## 8.3 D400 Configuration Utility

The D400 Configuration Utility is used to configure operating system (Linux) specific settings on the D400. Using the D400 Configuration Utility, you can perform the following actions:

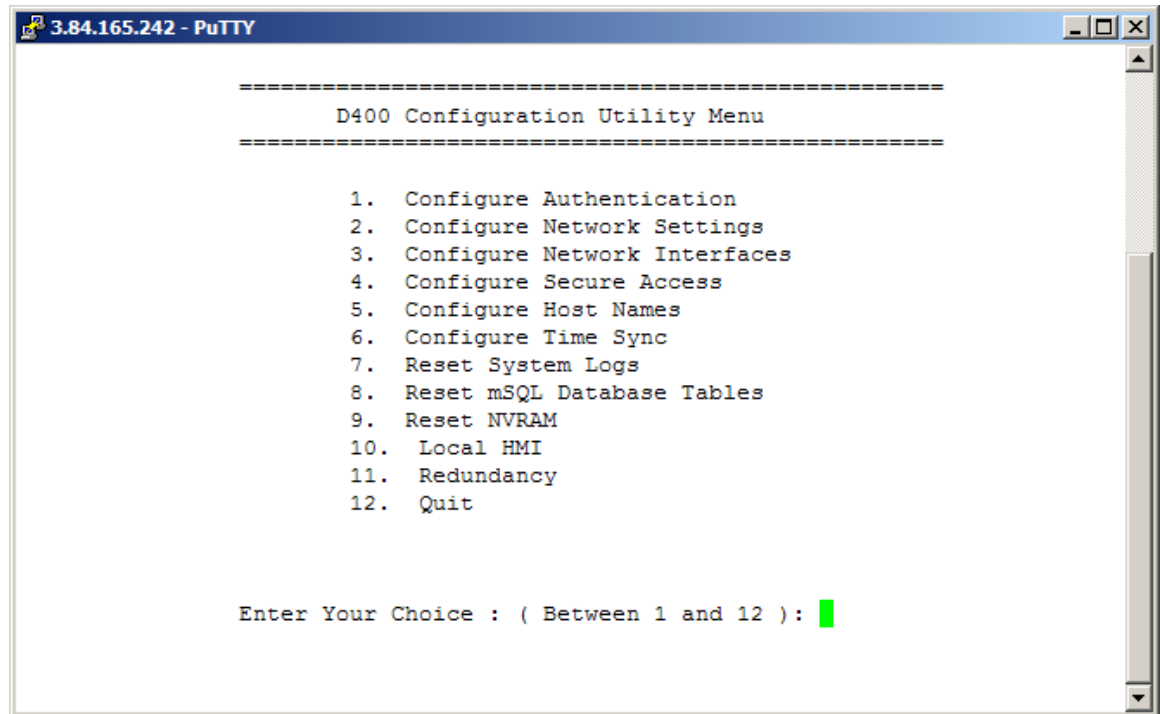
- Control user authentication mode
- Configure network and network interface settings
- Configure secure access
- Configure host names
- Configure time synchronization
- Reset system logs
- Reset mSQL database tables
- Reset NVRAM
- Configure KVM monitor settings

The D400 Configuration Utility differs from the D400 Configuration Tool in the D400 HMI in that it directly modifies Linux system configuration files rather than generating XML configuration files.

» To start the D400 configuration utility

- At the D400#>> command prompt, type **d400cfg** and press **Enter**.

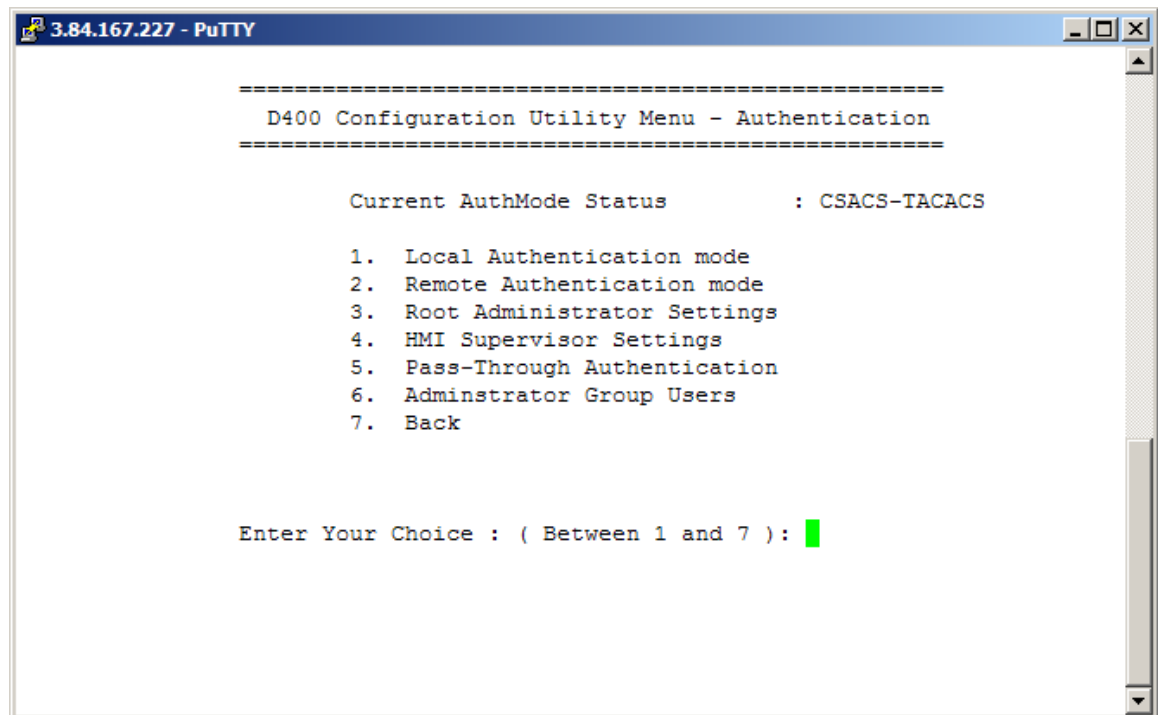
The D400 Configuration Utility menu appears.



To select a function, type the number and press **Enter**.

## Configure Authentication

From the **Authentication** menu, you can select the authentication mode and change the system access settings.



### Local Authentication Mode

Local authentication makes use of files stored locally to control user authentication, as opposed to connecting to a remote server to obtain user name and password information.

The D400 has two types of administrative users.

- Root – Full privileges to view and modify all system settings in the D400 and run commands through the local D400 command line interface. The root user cannot log into remote command-line services or the D400 HMI.
  - Default user name is **root** and the default password is **geroot**. Only the password can be modified (see *Root Administrator Settings* on p. 174).
- Administrator – Supervisor-level access to all configuration, runtime, operation, and system administration screens in the Online D400 HMI as well as full access to run commands at the D400 command line interface when the **sudo** command is used (see section 8.2 *Setting up a Terminal Session*). If you are using local authentication, Administrator-level users can be created using the D400 configuration utility (see *Administrator Group Users* on p. 174).

**Tip:** If you enable local authentication mode, be sure to create at least one administrator-level user before exiting from the D400 configuration utility. If you log out of the system without creating any new administrator users, you will not be able to log into the D400 remotely.

### Remote Authentication Mode

The D400 supports two remote authentication modes:

- RADIUS
- Cisco® TACACS+

RADIUS remote authentication mode requires the following settings:

- RADIUS server address – valid IPV4 address
- “Shared secret” as provided by the RADIUS administrator – 6 or more characters

Cisco TACACS+ remote authentication mode requires the following settings:

- TACACS+ server address – valid IPV4 address
- Encryption – select whether to enable or disable encryption for the connection between the D400 and the TACACS+ server

Refer to *Cisco TACACS+* on p. 206 for information on configuring your TACACS+ server.

### Root Administrator Settings

Allows you to change the password associated with the system *root* user account.

### HMI Supervisor Settings

HMI supervisors are allowed full privileges to access to all configuration, runtime, operation and system administration screens in the D400 HMI. One default supervisor account with the username **supervisor** is always available on the D400. You can set the password of this account using the D400 configuration utility.

Password aging requires the following settings:

- Maximum number of days the password will be valid for
- Number of days to warn the user before a password change is required
- Date on which accounts (except administrator) will expire (if account expiration is enabled)
- If account expiration is enabled. Set to 0 to disable.

### Pass-through Authentication

Allows you to enable or disable pass-through authentication. When authentication is enabled, a valid username and password is required to access client applications through pass-through ports. Enabled by default.

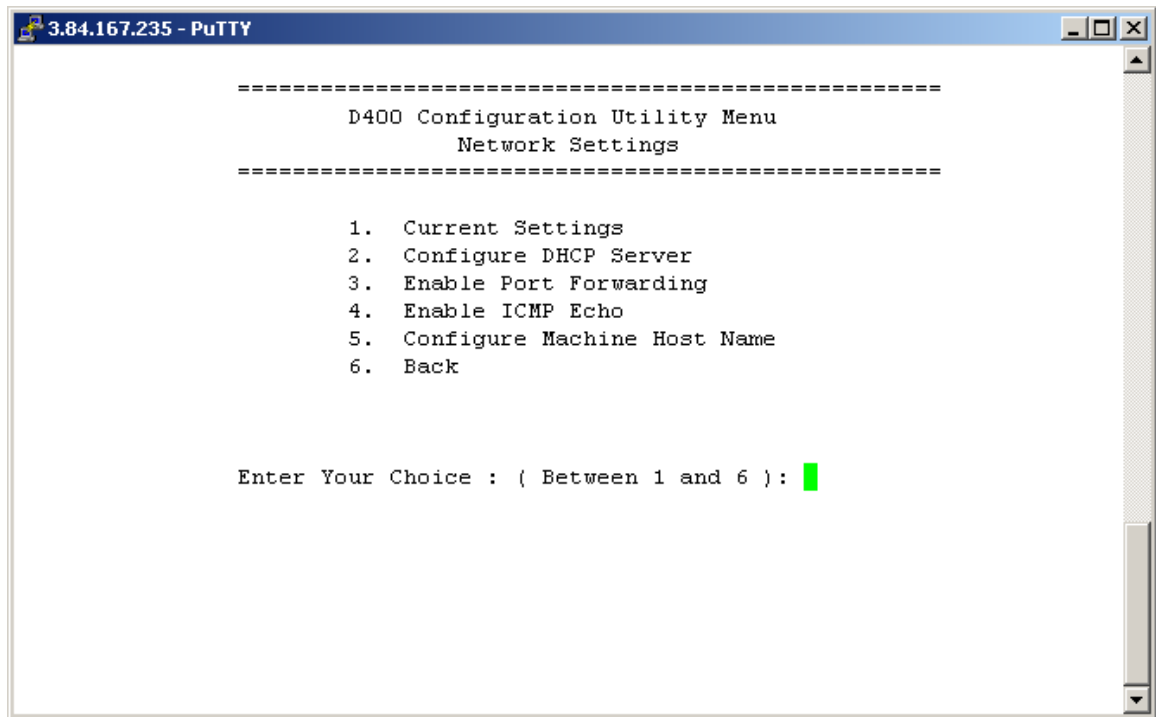
### Administrator Group Users

Allows you to create administrator-level users (if you are using local authentication mode) and to change details associated with existing administrator user accounts.

### Configure Network Settings

The **Network Settings** menu includes optional settings for the D400 network interface.

**Note:** The D400 must be rebooted to activate changed network settings.



### DHCP Server

Allows the D400 to act as a DHCP Server. Following settings are available for customization:

- Ethernet Interface (eth0 and eth1)
- IP-Address and Subnet Mask for use by the D400 Server
- Gateway address (by default, no gateway configured)
- Start and End addresses to be used by the dynamic assignment

### Port Forwarding

Allows a device on the D400 first network interface to communicate with devices coming in on a second network interface or a dial up connection. This requires configuration only if the D400 has two Ethernet interfaces and/or will use PPP dial-in and require access to network devices external to the D400.

### ICMP Echo

ICMP echo is a feature to help with securing the D400. By default the D400 cannot be pinged on any interface, but it can be enabled if required by the administrator.

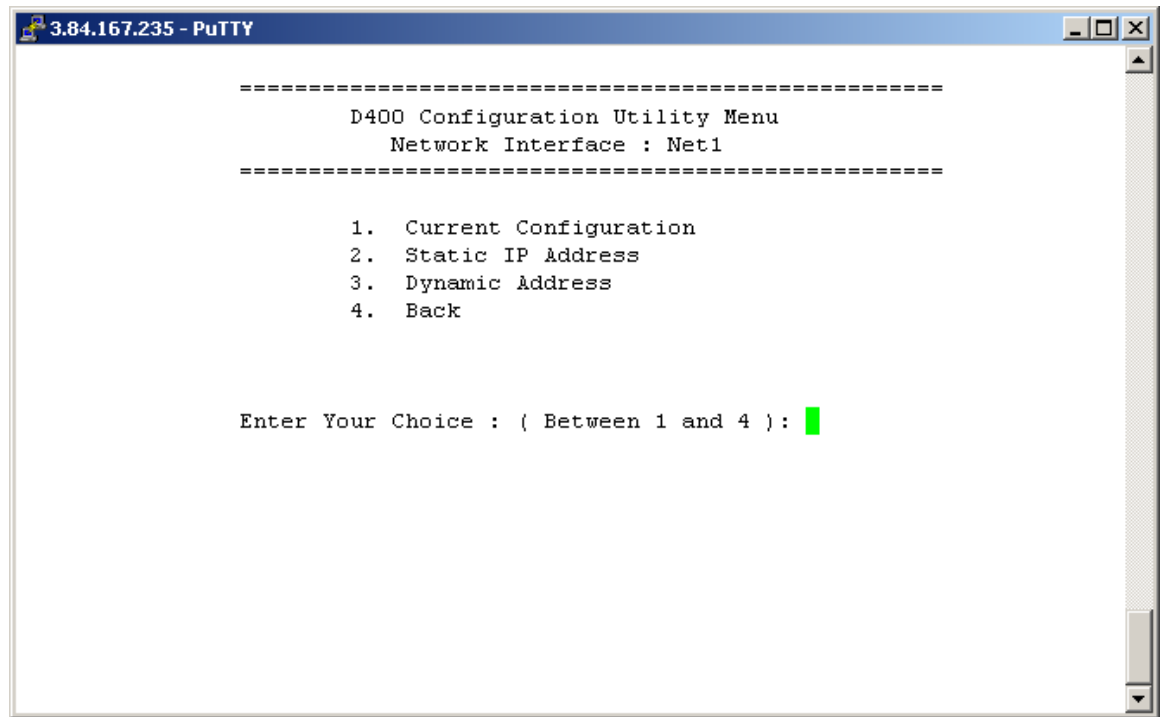
### Host Name

Used to assign a host name to the D400 unit. The name must be unique to this D400 and only contain alphanumeric characters (- [hyphen] is supported).

### Configure Network Interfaces

The **Configure Network Interfaces** menu includes settings for the D400's network connections.

**Note:** The D400 must be rebooted to activate changed network settings.



### Static IP Address

Configures the D400 to use manually defined network parameters. All addresses must be on different subnet masks. Configurable addresses include:

- **Maintenance:** Also referred to as the static address, this is the primary IP address and subnet mask for use by this D400.
- **Active:** Used for D400 system redundancy. Whichever redundant D400 is active at the time will assume this IP address; the standby unit reverts to its own maintenance IP address. The active address settings should be the same on both redundant units.
- **Alias:** An alternate address that can be configured to allow a secondary communications link with the D400. This is typically used for redundant LAN D25s. When used within a redundant D400 system setup, the alias address settings should be the same on both redundant units.

If your D400 contains a second Ethernet card, you can configure secondary maintenance, active, and alias IP addresses.

### Dynamic Address

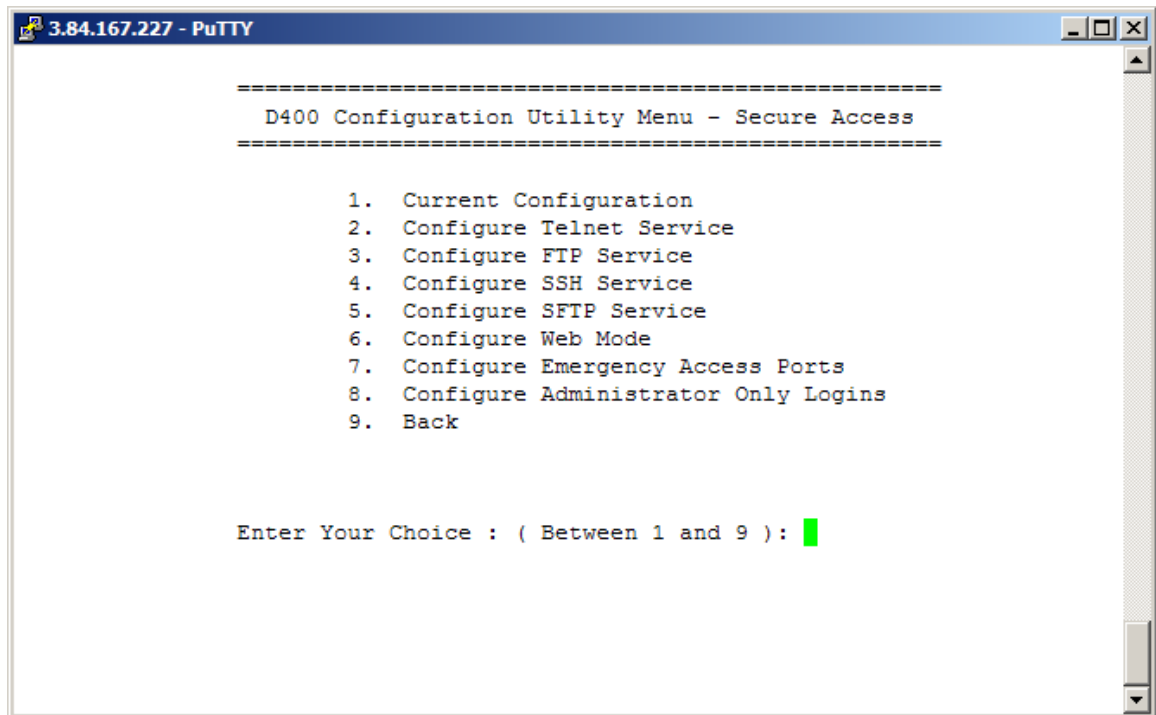
Configure the D400 to use network parameters that are provided by a DHCP server.

**Note:** Dynamic addressing is not compatible with D400 system redundancy or redundant LAN D25s as the active and alias addresses are not provided by DHCP.

### Configure Secure Access

The **Configure Secure Access** menu allows you to configure the modes through which users can access the D400.





### Configure TELNET Service

Enable or disable access to the D400 through the TELNET protocol

### Configure FTP Service

Enable to disable access to the D400 through the FTP protocol

*Note:* When transferring files to and from the D400, you may receive file permission errors. Disable "permission change error reporting" in your file transfer utility to prevent these messages from appearing.

### Configure SSH Service

Enable or disable access to the D400 through the SSH protocol

### Configure SFTP Service

Enable or disable access to the D400 through the Secure FTP protocol

*Note:* When transferring files to and from the D400, you may receive file permission errors. Disable "permission change error reporting" in your file transfer utility to prevent these messages from appearing.

### Configure Web Mode

Select if users can access the D400 web interface through an HTTP connection or if users should be redirected to an HTTPS connection

### Configure Emergency Access Ports

By default, the root user cannot access the D400 remotely. Instead, this account can only be used to access the D400 locally through one of the configured emergency access ports.

### Configure Administrator Only Logins

Select if access to command-line utilities is restricted to Administrator-level users or not. By default, this option is enabled. This setting restricts access to the following services:

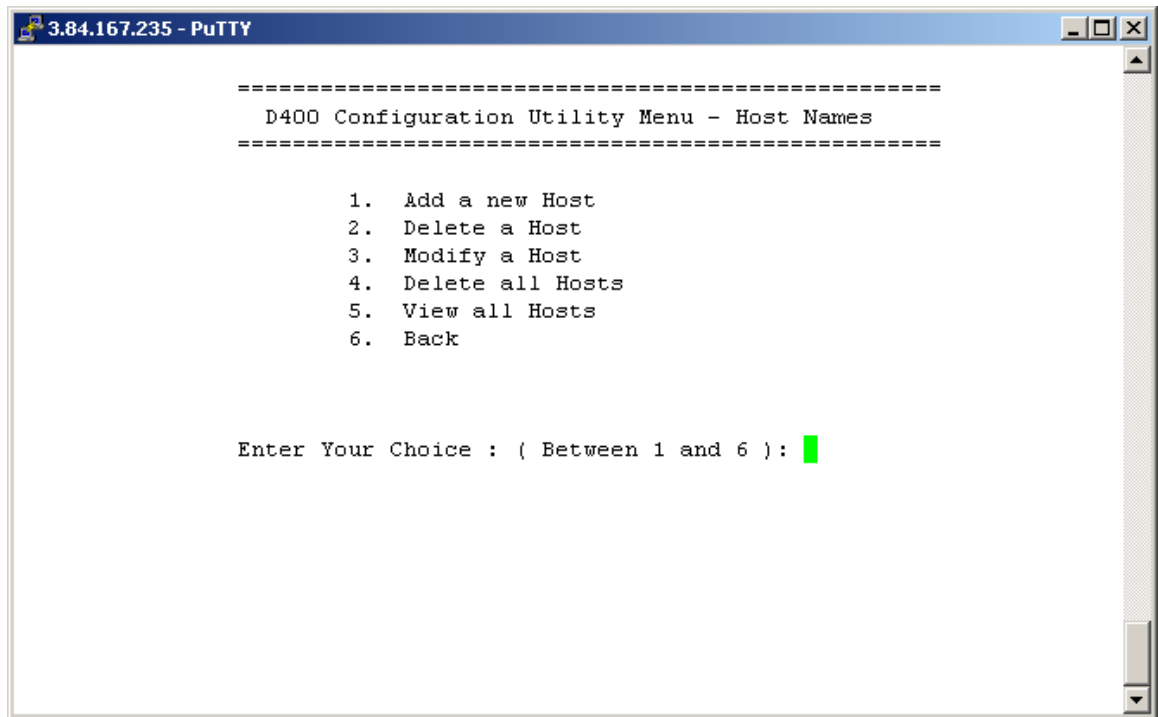
- Login
- SSH
- SFTP
- Telnet
- FTP
- getty
- mgetty

**Note:** The root user is not able to access these services at any time unless it is through one of the configured emergency access ports.

### Configure Host Names

The **Configure Host Names** menu allows you to assign a host name to your D400 and to view, add, and delete entries in the hosts file.

**Note:** The D400 will only allow you to enter IPV4 addresses.



#### Add a New Host

This option prompts you to add a host name and IP address to the hosts file.

#### Delete a Host

Provides you with a list of configured hosts. Select an item number to delete the associated host entry.

### Modify a Host

Provides you with a list of configured hosts. Select an item number to modify the associated host name and IP address. Press **Enter** to use the previously entered value.

### Delete all Hosts

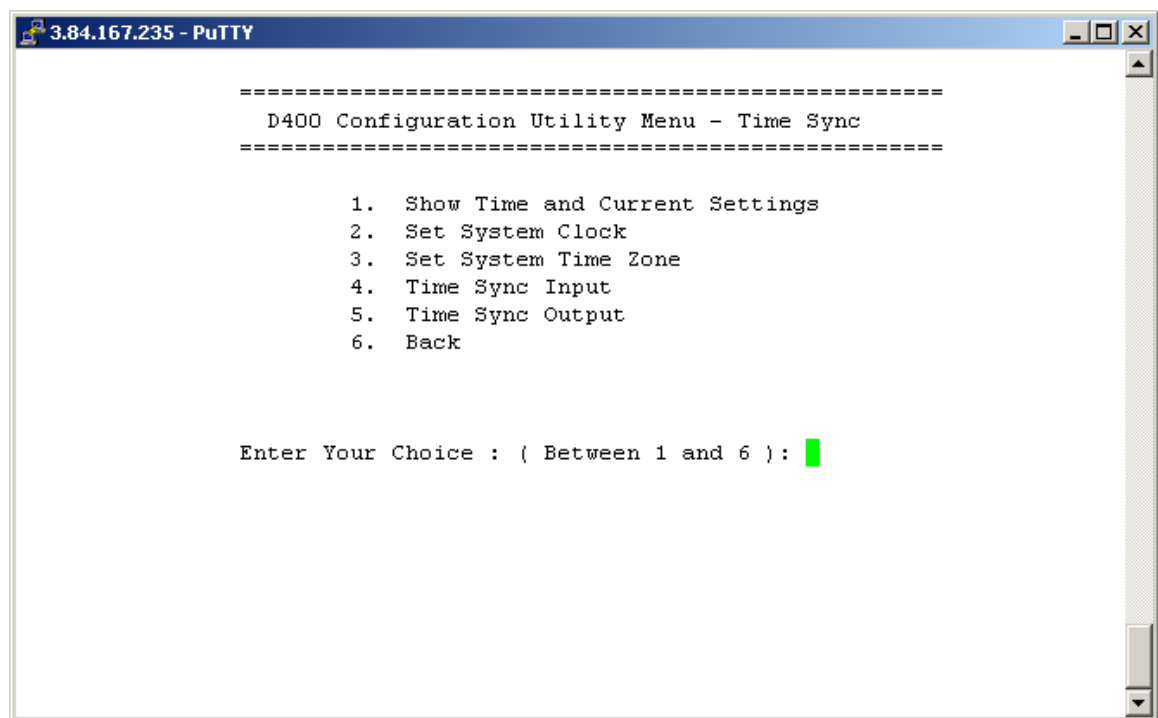
This option will remove all entries from the hosts file.

### View all Hosts

Provides you with a list of configured hosts.

## Configure Time Synchronization

The **Configure Time Synchronization** menu allows you set the D400's internal date and time as well as modify options associated with time synchronization.



### Set System Clock

Enter the current calendar date and time of day. The value entered will be recorded in the D400.

### Set Time Zone

Enter the time zone of the D400.

**Note:** The D400 uses the IEEE POSIX® standard for time zone naming. POSIX uses the time zone offset to get GMT from the local time (that is, GMT – local time) instead of the more common format (local time – GMT). For example, Eastern Standard Time in North America, which is 5 hours behind GMT, is listed as "GMT+5", and not "GMT-5".

### Time Sync Input

Configures the D400 to use either IRIG-B or NTP/SNTP to calibrate the system clock.

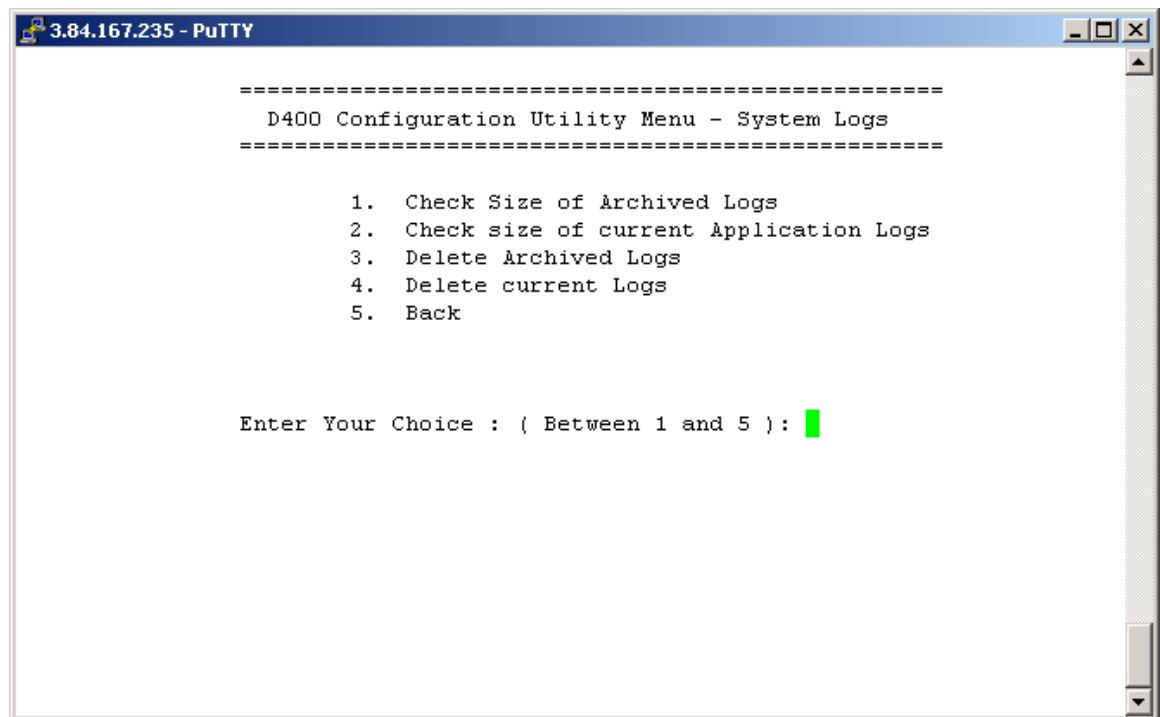
- **IRIG-B:** Enter the IRIG-B format, options are TTL (pulse width code), Sine wave (amplitude modulated), and Manchester.  
Ensure SW2 of the IRIG-B Input Adapter is configured for the proper input type: Fiber Optic or TTL for *TTL* and *Manchester*, BNC for *Sine wave*.
- **NTP:** Enter the IP address of the NTP server. The D400 will verify if the source is accessible by pinging the address.

### Time Sync Output

The D400 can be configured to operate as an NTP time server.

### Reset System Logs

You can use the **Reset System Logs** menu to clear various system logs that are stored in the D400.



#### Check Size of Archived Logs

Active system logs are automatically archived when they reach a size of 256 KB. Up to 10 archives are kept within the D400, with newer logs overwriting older stored logs.

**Check Size of Archived Logs** lets you view the amount of disk space occupied by these archived log files. The value is shown in KB.

#### Check Size of Current Application Logs

View the amount of disk space occupied by the current application logs. The value is shown in KB.

#### Delete Archived Logs

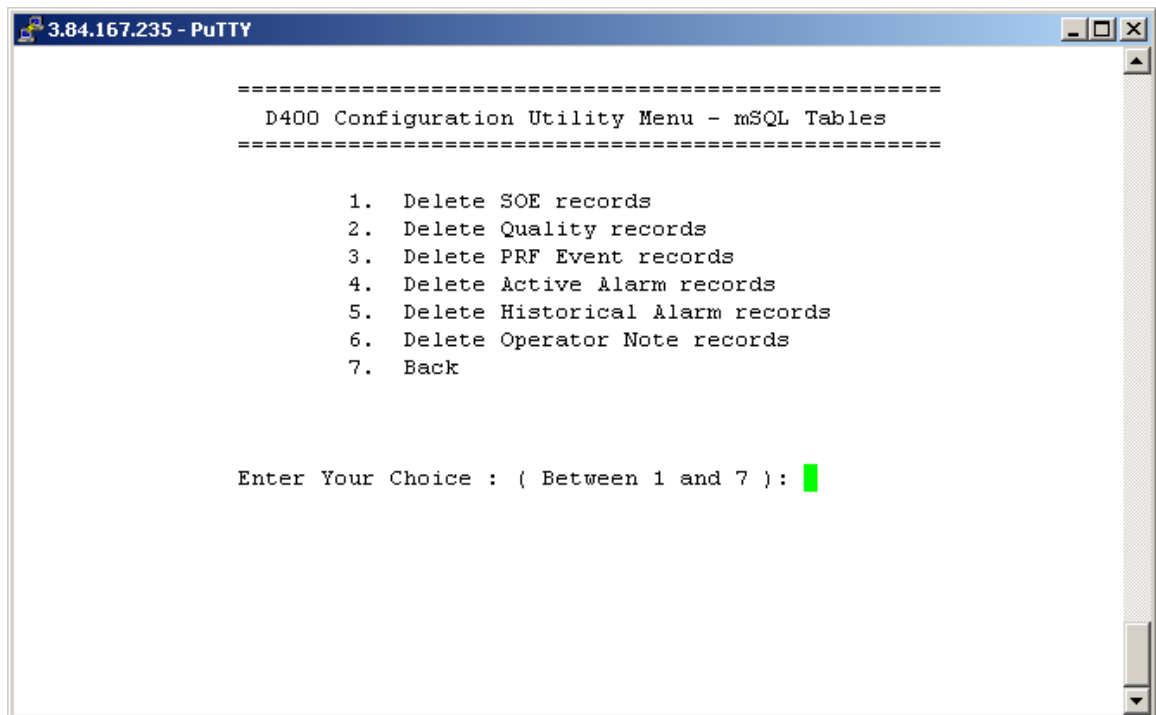
Permanently delete archived logs from the D400.

#### Delete Current Logs

Permanently delete current application logs from the D400.

## Reset mSQL Database Tables

You can modify tables in the mSQL database through the **Reset mSQL Database Tables** menu.

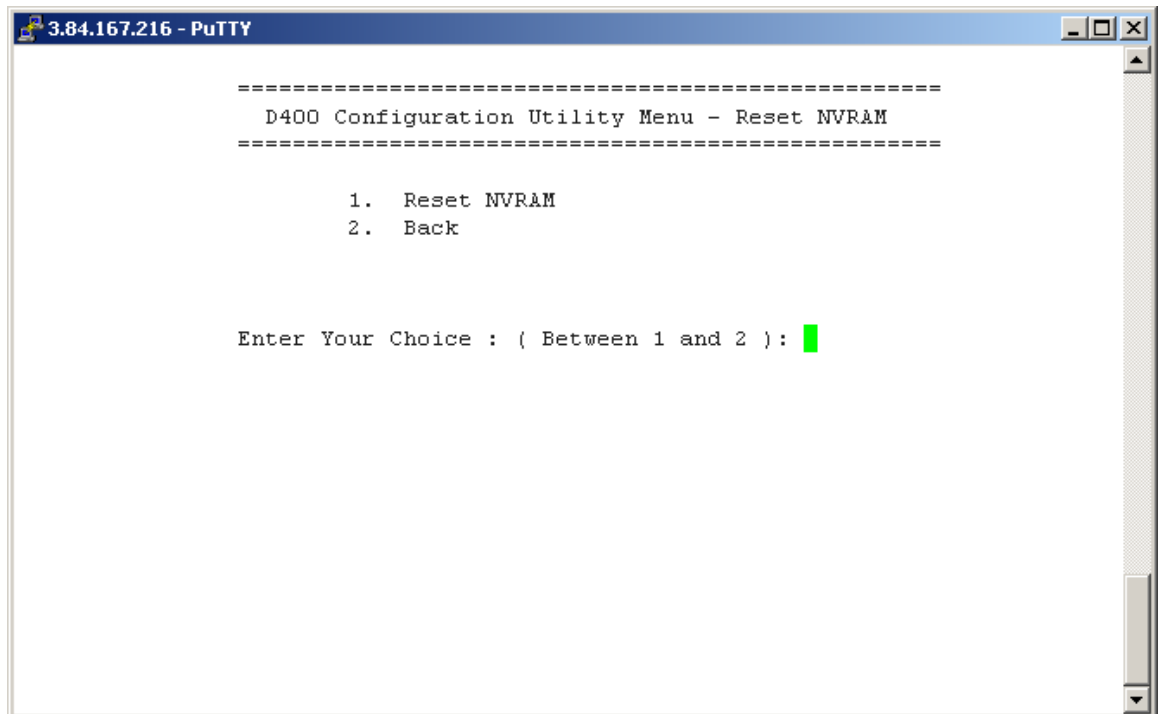


To delete records from the D400, select a line item from the list. During the deletion, the mSQL database will be locked for reading or writing.

**Important!** Once you have finished deleting records from the mSQL database, exit the D400 Configuration Utility and reboot the D400 by entering **shutdown -r now**.

## Reset NVRAM

You can reset the data being held in NVRAM through the **Reset NVRAM** menu.



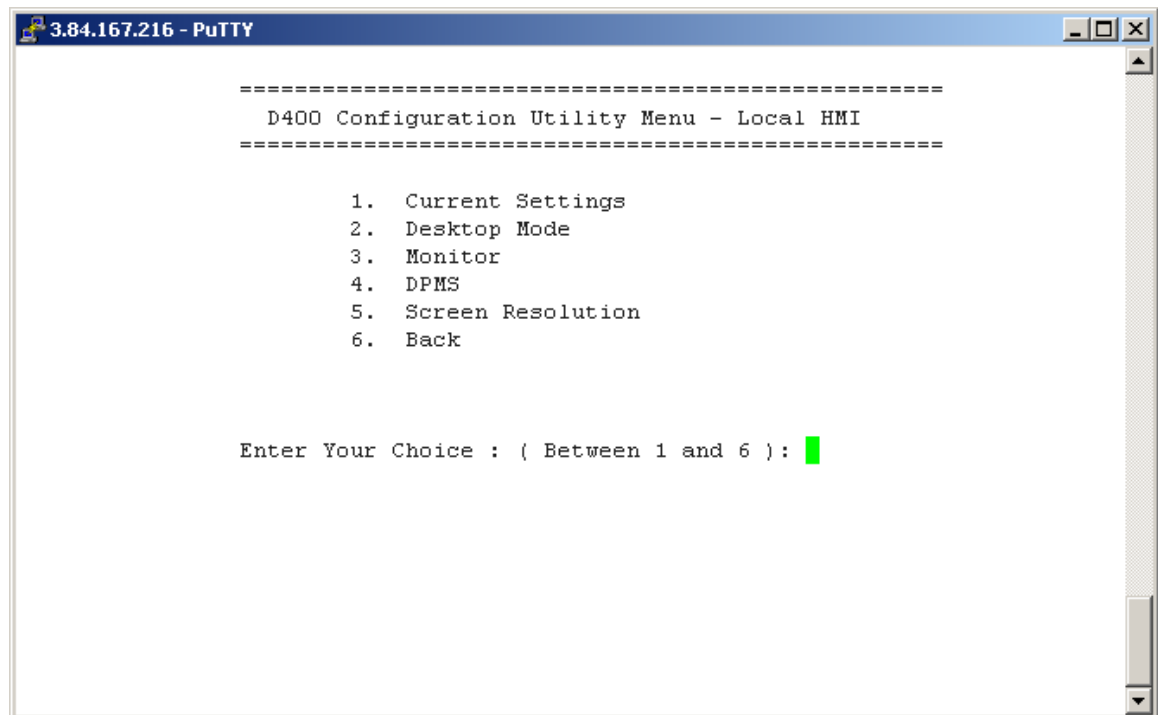
## Reset NVRAM

Permanently delete data stored in the NVRAM of the D400.

**Note:** After you have reset the NVRAM, you must restart the processes running on the D400. To do this, exit the D400 Configuration Utility, type **go** at the command line, and press enter.

## Local HMI

You can configure the settings of the local KVM monitor output through the **Local HMI** menu.



### Desktop Mode

Enable or disable “kiosk” mode. Kiosk mode will display the local HMI full screen rather than windowed.

### Monitor

Enter the horizontal and vertical refresh rates, in hertz.

**CAUTION:** Never exceed the maximum refresh rates of your monitor as damage may occur. Refer to the manual that came with your monitor for more information.

### DPMS

Enable or disable Display Power Management Signaling. These settings determine how much time must pass without user interaction before your monitor is put into a reduced power mode. A setting of “00” will prevent the D400 from triggering the power mode.

The following modes are available:

- Stand-by: Monitor blanks but power supply remains on; screen restores in approximately one second when reactivated by keyboard or mouse input by user.
- Suspend: Monitor power supply shuts off; screen restores in approximately 2-3 seconds
- Turned off: Monitor is fully powered down except for an auxiliary circuit to detect a wake-up signal; screen restores in approximately 8-10 seconds

**Note:** Refer to the manual that came with your monitor for more information on how it receives and responds to DPMS signals.

### Screen Resolution

Select one of three output resolutions:

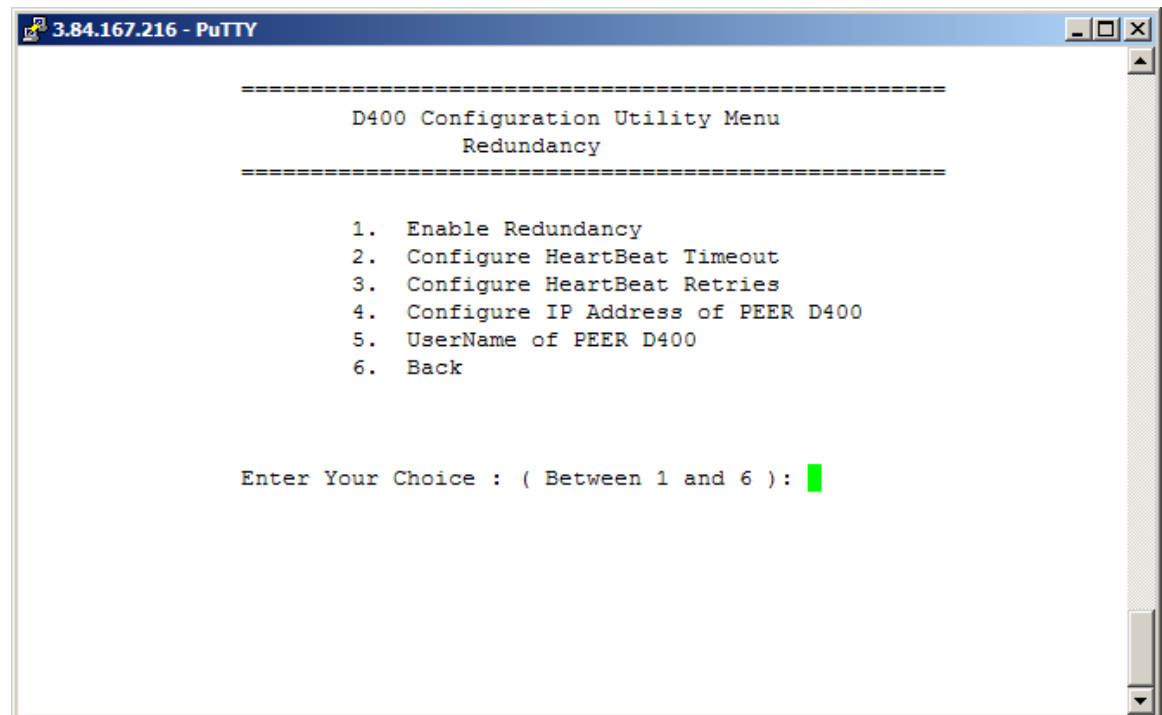
- 1280 x 1024
- 1024 x 786
- 800 x 600

**CAUTION:** Never exceed the maximum resolution of your monitor as damage may occur. Refer to the manual that came with your monitor for more information.

### Redundancy

If you are configuring your D400 for use within a redundant setup, you can configure redundancy application settings through the **Redundancy** menu.

The secondary standby IP configuration option is only available if a second Ethernet interface is installed and configured within the D400.



#### Enable Redundancy

Enable or disable redundancy functionality within the D400.

#### Configure Heartbeat Timeout

The interval within which the D400 must receive at least one message or heartbeat from the other D400. Valid ranger is 100 to 1000 ms; default is 300 ms.

#### Configure Heartbeat Retries

The number of times the D400 re-transmits a heartbeat message before assuming that the other D400 has failed. Valid range is 1 to 300; default is 3.



### Configure IP Address of Peer D400

Set the unique IP address of the other D400 device configured within the redundant system. If the peer D400 has a second Ethernet interface, you can configure it as well.

### Username of Peer D400

Enter the username of the root-level user account on the peer D400 unit. This username must be **administrator** when using remote authentication mode. Generally, this setting is the same on both D400 units. This setting is used in conjunction with the authentication mechanism defined in appendix B.3 *Ethernet Connections*.

## 8.4 PPP Dial-In

The D400 supports a PPP dial-in connection from a host computer using a Telnet or Secure Shell terminal session. To establish a PPP connection, the D400 must have a COM2 adapter card installed and configured for DTE communications.

The PPP Dial-In connection is configured at the D400 command prompt.

**Note:** This configuration command involves first editing the configuration file in the D400 RAM disk and then copying the changed file to the user CompactFlash disk.

### » To set up a PPP interface

1. Start a terminal session and log into the D400.
2. At the D400#>> prompt, type **vi /etc/ppp/options.ttyS1** and press **Enter**.  
The default D400 IP address and host IP address are displayed in the format *D400 IP address : host IP address*, as follows:  
**192.168.169.2 : 192.168.169.1**
3. If desired, modify the host IP address (the second IP address displayed).
4. To save your changes and exit the command, type **:wq** and press **Enter**.  
The D400 command prompt appears.
5. At the D400#>> prompt, enter the following commands:  
**mkdir -p /home/D400\_SysConfig/etc/ppp**  
**cp /etc/ppp.options.ttyS1 /home/D400\_SysConfig/etc/ppp**  
The configuration is saved to the User CompactFlash.
6. If you haven't already done so, set up the host computer for a basic dial-up connection and use the D400 administrator user name and password.  
The D400 is now set up to transfer data through a dial-in connection.

---

## 8.5 Pass-Through Connections

For client applications that support pass-through connections, these connections are accessible through a TCP port on the D400. You can connect to the device through the D400 using PC-based configuration tools and, if necessary, COM port redirection software.

### » To enable client pass-through connections

1. On the **System Wide** tab of the D400 Online Configuration Tool, click **Security** in the left hand menu.
2. For **Pass-Through and Terminal Server Access**, select **Allow Network Connections**.

The port number is automatically assigned as 8000 plus the serial port number the client is using. For example, if the client is configured to use serial port 1, the pass-through connection port is 8001.

To enable pass-through connections on a serial port without enabling a client application, the port must be configured as an automatic terminal server.

### » To enable pass-through connections without a client application

1. On the **Connection** tab of the D400 Online Configuration Tool, configure the port as **Terminal Server**.
2. Set the Startup parameter to **Automatic**.
3. On the **System Wide** tab of the D400 Online Configuration Tool, click **Security** in the left hand menu.
4. For **Pass-Through and Terminal Server Access**, select **Allow Network Connections**.

The port number is automatically assigned as 8000 plus the serial port number. For example, if the terminal server is assigned to serial port 2, the pass-through connection port is 8002.

---

## 8.6 Direct Connect

Using the D400connect utility, you can communicate directly with devices via the D400. The d400connect utility establishes a terminal session with a device connected to one of the D400 serial ports and transfers binary data without modification.

The direct connect utility is set up at the D400 command prompt.

**Note:** You cannot launch the d400connect utility on a serial port that already has an automatic terminal server configured.

**>> To start d400connect**

1. Connect and configure devices in the D400 Configuration Tool.
2. Start a terminal session and log into the D400.
3. At the D400#>>, enter the following commands

```
cd /home/D400_APPS/
```

```
./d400connect -d -u <D400 port number>
```

For example, the command in the format `./d400connect -d -u 1` enables communications to a device connected to Serial Port 1 on the D400.

The device command prompt is displayed.

4. Configure or query the connected device as usual.

**Tip** Type `./d400connect -h` to view help information about the tool

**>> To exit d400connect**

- Press **CTRL + C**, and press **Enter**.  
The D400 command prompt appears.

**8.7****D400 Configuration Manager**

The D400 Configuration Manager provides two modes of operation. In redundant systems, the utility synchronizes configurations between the two D400 units to ensure that both are configured identically. In non-redundant setups, you may launch it manually to copy configurations from the current D400 to another D400 connected over a network or to a location in the D400's file system, like a connected USB drive.

In redundant systems, the D400 Configuration Manager can also be activated by operating the *SyncConfig* digital output point, which copies the configuration from the active unit to the standby unit. See section 6.5 *D400 Redundancy Manager* for more information.

**Note:** The D400 Configuration Manager does not synchronize the configuration parameters defined in the *d400cfg* utility. You must apply these settings manually.

**>> To use the D400 Configuration Manager:**

1. Start a terminal session and log into the D400.
2. At the prompt, enter the following command:

```
./configmgr.pl <command line parameters>
```

When executing the application, the following command-line parameters are accepted:

Parameter	Description	Arguments
-m	Mode	<i>network, local, or tar.</i>

Parameter	Description	Arguments
-i	IP Address (network mode only)	The IP address of the remote D400 device.
-l [Lower-case L]	Local Path (local and tar modes only)	The local path to transfer the configuration to. In local mode, the entire directory structure containing the configuration files is copied to a specified location (for example, the path to a USB drive may be <i>/dev/sda1</i> ). In tar mode, the configuration files are stored in a single compressed archive file. When specifying the path, include a filename ending in <b>.tar.gz</b>
-u	Username (network mode only)	Username that is used to access the remote D400 unit.
-p	Password Prompt (network mode only)	<i>yes, no</i> . If a password is required to access the network D400 device, entering <i>yes</i> for this parameter will prompt you for a password during the connection. If <i>no</i> is entered, SSH key authentication must be enabled to allow communication between the D400 devices. See <i>To Configure Public Key Authentication</i> below. If the <i>-p</i> parameter is not specified, the default action is <i>yes</i> .
-f	Reset Flag	<i>yes, no</i> . Entering <i>yes</i> will trigger a restart of all applications running on the remote D400 device once the configuration has been synchronized. If <i>no</i> is entered, the applications will not be restarted. If the <i>-f</i> parameter is not specified, the default action is <i>no</i> .

For example, to trigger a network synchronization followed by a restart of the applications running on the remote unit, you would enter the command:  
**`./configmgr.pl -m network -i <IP address of remote computer> -u <username of remote D400 unit> -p yes -f yes`**

If the transfer of the configuration is successful, a confirmation notice is displayed. If any errors occur, a description of the failure is shown.

## » To Configure Public Key Authentication

When redundancy mode is enabled in `d400cfg`, public and private SSH keys are automatically created for you. Follow these steps to enable authentication between both redundant D400 units.

1. Log onto the terminal of D400 B and enter the following command:  
**`cd /mnt/data1og/SSHKeys/`**

2. Create a directory using the user name configured on D400 A in **Redundancy** > **User Name of PEER D400** using the following command:

```
mkdir <user name>
chmod 770 <user name>
cd <user name>
```

3. Enter the following commands to copy the public key from D400 A:

```
scp <admin user name>@<IP address of D400 A>:/mnt/datalog/SSHKeys/id_rsa.pub authorized_keys
chmod 660 authorized_keys
```

4. Log onto the terminal of D400 A and enter the following command:

```
cd /mnt/datalog/SSHKeys/
```

5. Create a directory using the user name configured on D400 B in **Redundancy** > **User Name of PEER D400** using the following command:

```
mkdir <user name>
chmod 770 <user name>
cd <user name>
```

6. Enter the following commands to copy the public key from D400 B unit:

```
scp <admin user name>@<IP address of D400 B>:/mnt/datalog/SSHKeys/id_rsa.pub authorized_keys
chmod 660 authorized_keys
```

## 8.8 Software Licensing Tools

The D400 contains a set of utilities to manage software licensing for optional applications and features. Licensing is controlled through a single license file stored on your D400.

### » To unlock an application using a license code:

1. Start a terminal session and log into the D400.
2. At the prompt, enter the following commands

```
cd /home/D400_APPS/
./swlic-unlock -l <26 digit license code>
```

**Note:** The parameter **-l** above is a lower-case letter "L"

The feature is unlocked and available for use.

### » To update existing D400 licenses using a batch file:

GE Energy can issue a batch license file, which contains licenses for multiple D400 units. This is useful when licensing features across many D400 units or when licensing several applications on one D400 unit.

1. Start a terminal session and log into the D400.
2. Connect a USB drive containing the D400 batch license file.
3. At the prompt, enter the following commands

```
cd /home/D400_APPS/  
./swlic-batch
```

The tool locates the license file and licenses all applicable features for the current D400. Repeat steps 1 to 3 for each remaining D400 unit.

» **To view detailed information on your D400 license:**

1. Start a terminal session and log into the D400.
2. At the prompt, enter the following commands

```
cd /home/D400_APPS/  
./swlic-report
```

The application output shows the D400 ownership information and a list of available features. Each item under **Application License** represents an application or feature that can be licensed. They are shown in the format:

*3 digit application ID number : Description of feature      License status*

There are four possible license statuses:

Unlocked	The feature has been licensed and is available for use.
Trial Disabled	A trial license is available for this feature. To enable, see the instructions below.
Trial Enabled (Expires YYYY-MM-DD)	The feature is available for use under a temporary trial license. The license will expire on the date shown.
Disabled	A trial license was used and the feature has now been disabled. This feature cannot be re-activated unless a license is purchased.

» **To enable a trial license for an application or feature:**

A 30-day trial license can be obtained for any application listed as *Trial Disabled* in the Application License report.

1. Start a terminal session and log into the D400.
2. At the prompt, enter the following commands

```
cd /home/D400_APPS/  
./swlic-trial -id <3 digit application ID number>
```

**Note:** The 3 digit application ID number can be obtained using the *swlic-report* utility.

The 30-day trial license is enabled for the feature. Once the 30 days has elapsed, the feature will be disabled. A trial license can only be enabled once for each feature.

**>> To obtain information about your D400:**

Some older D400 units may not contain a license file. In this case, Customer Service can generate a replacement license file for you. To do this, you must provide unique identifying information about your D400.

1. Start a terminal session and log into the D400.
2. At the prompt, enter the following commands  
**cd /home/D400\_APPS/  
./swlic-info**

Provide the information shown to Customer Service.

---

## 8.9 Emergency Access Code

In the event that you cannot log into your D400, you can generate an emergency access code that will bypass user authentication and give you access to the local or remote HMI. This can be useful in situations where your remote authentication server is temporarily unavailable.

You can only create an emergency access code when you are logged in as the root user and you must be connected to the D400 through one of the configured emergency access ports (refer to *Configure Secure Access* on p. 176).

**>> To generate an emergency access code:**

1. Start a terminal session through one of the configured emergency access ports.
2. Log into the D400 using the root account.
3. At the prompt, enter the following commands  
**cd /home/D400\_APPS/  
./emergencyaccess -gen**

An emergency access code is generated and displayed on screen. This code remains valid for five minutes after being created or until someone logs in with it.

The emergency access code can only be used to log into the HMI of your D400; you cannot use it connect to command-line services like TELNET or SSH.

**>> To manually clear an emergency access code that has been generated:**

1. Start a terminal session through one of the configured emergency access ports.
2. Log into the D400 using the root account.
3. At the prompt, enter the following commands  
**cd /home/D400\_APPS/  
./emergencyaccess -clear**

The emergency access code is cleared from the system and the standard HMI login screen is displayed again.

**Note:** Emergency access codes are automatically cleared by the D400 immediately after being used or five minutes after being generated, whichever comes first.




# A

## Application Pseudo Points

Applications may provide status information and allow functions or operations to be initiated through system and/or device level pseudo points. These points can be accessed through the Point Summary page of the Online HMI.

### >> To access pseudo points:

1. Log into the online HMI of the D400 unit.
2. Click the  **Point Summary** button on the toolbar.
3. Under the **Application** tab, click the **Details** button for the selected application.
4. Select the appropriate point type tab to view all points belonging to the group.
5. To send a control request, right-click the point and select **Forcing**.

### IEC 61850 Application

Table 151 IEC 61850 Application, Global, Digital Output

Point Name	Description	DO State Set to ...
Retrieve All Data Sets from All IEDs	This control queues an integrity request for every data set on every device.	Completed (0)
		Pending (1)
Global "DisableDevice"	This control disables communications to all devices belonging to the application. If disabled, the application does not have an open association with any of its devices, or send user requests to any device. When it is set to Enabled, the application sets the device state to its previous state.	Disabled (1)
		Enabled (0)

Point Name	Description	DO State Set to ...
Enable Polling of All IEDs	This control disables or enables data set retrieval from all devices belonging to the application, but leaves the associations up and does not prevent other controls such as "Retrieve All Data Sets from IED" or "Force to Alternate Channel". The application stops polling all devices and disable all Report Control Blocks.	Disabled (0)
		Enabled (1)
Force All IEDs Off Primary Channel	This control clears all devices off the requested channel	Clear Primary Channel (1)
		Clear Secondary Channel (0)

Table 152 IEC 61850 Application, Global, Digital Input

Name	Description	DI State Set to ...
Global "DeviceDisable"	Communications is disabled to all devices owned by the application. Reflects the status of the Global "DisableDevice" Digital Output pseudo point.	Disabled (1)
		Enabled (0)
Enable Polling of All IEDs Status	Automatic data retrieval from devices is globally disabled. Reflects the status of the "Enable Polling of All IEDs" Digital Output pseudo point.	Disabled (0)
		Enabled (1)
DCA Status	Indicates if the application is running.	Enabled (1)
		Disabled (0)

Table 153 IEC 61850 Application, Per-Device, Digital Output

Name	Description	DO Status Set to ...
Retrieve all Data Sets	This control queues a poll request for every locally configured Data Set on the device.	Completed (0)
		Pending (1)
DisableDevice	This control disables or enables communications to the IED. If disabled, the application shall not have an open association with the device, nor accept user requests for the device.	Disabled (1)
		Enabled (0)
Enable Polling of IED	This control disables or enables data set retrieval from the device, but leaves the association up and does not prevent other controls such as "Retrieve all Data Sets" or "Force to Alternate Channel". The application will also disable all Report Control Blocks when this control is disabled.	Disabled (0)
		Enabled (1)
Force IED to Alternate Channel	This control forces the device to the alternate communications channel.	Completed (0)
		Pending (1)

**Table 154 IEC 61850 Application, Per-Device, Digital Input**

Name	Description	DI State Set to ...
Primary Channel Health	Indicates health of primary communications channel. If primary channel is in use, Normal health means the association is up. If primary channel is not in use, Normal health means an association is possible on this channel. Failed health means the last association attempt failed.	Failed (0)
		Normal (1)
Secondary Channel Health	Indicates health of secondary communications channel. If secondary channel is in use, Normal health means the association is up. If secondary channel is not in use, Normal health means an association is possible on this channel. Failed health means the last association attempt failed.	Failed (0)
		Normal (1)
Primary Channel Status	Indicates if primary channel is In Use or Not In use. In use status means this channel is the active channel and the association is up on this channel.	Not In Use (0)
		In Use (1)
Secondary Channel Status	Indicates if secondary channel is In Use or Not In Use. In use status means this channel is the active channel and the association is up on this channel.	Not In Use (0)
		In Use (1)
		Overflow (1)
Report Buffer Overflow	Indicates if the device has reported a buffer overflow condition in one of its buffered report control blocks.	No Overflow (0)
		Overflow (1)
Retrieve All Data Sets from IED Status	Operation to retrieve All Data Sets from device that was triggered by either the "Retrieve All Data Sets from All IEDs" or the "Retrieve All Data Sets from IED" pseudo Digital Output is either completed or under way.	Completed (0)
		Pending (1)
DeviceDisable	Device is enabled or disabled as controlled by the DisableDevice Digital Output or the Global "DisableDevice" Digital Output.	Disabled (1)
		Enabled (0)
Polling of IED Status	Polling is enabled or disabled as controlled by the "Enable Polling to IED" Digital Output or the "Enable Polling of All IEDs to IED" Digital Output.	Disabled (0)
		Enabled (1)

Name	Description	DI State Set to ...
Configuration Comparison Status	Indicates whether the most recent configuration comparison for this device failed. The application compares the composition of the device's Data Sets with what it has configured locally.	Failed (0) The DCA logged the discrepancies it detected.
		OK (1) There were no discrepancies in the most recent comparison.
Device Online	Indicates whether communications with the device is Active (Online) or Inactive (Offline)	ON (1)
		OFF (0)

Table 155 IEC 61850 Application, Per-Device, Analog Input

Name	Description	Value of the AI point
"AddCause for ..."	This point is created for each field DO and AO point. The name of the pseudo point includes the point name of the associated DO or AO field point.	See note below.

**Note:** The value of this field indicates the result of the last AO or DO operation on an IEC 61850 enhanced security control (see the following table). For IEC 61850 normal security controls, the values are 0 for commands that are successfully sent and -255 for commands that fail to send.

For enhanced security controls, a non-zero value indicates failure; a zero value indicates success. A positive value indicates one of the IEC 61850 Additional Causes was reported by the device. A negative value larger than -255 indicates a low-level MMS error was reported by the device. A value of -255 indicates another error condition not specifically listed has occurred.

Error Class	Error Description	Value of AI
Unknown Error	Unknown error.	-255
DataAccessError	object-non-existent	-10
DataAccessError	object-access-unsupported	-9
DataAccessError	object-attribute-inconsistent	-8
DataAccessError	type-inconsistent	-7
DataAccessError	type-unsupported	-6
DataAccessError	invalid-address	-5
DataAccessError	object-undefined	-4
DataAccessError	object-access-denied	-3
DataAccessError	temporarily-unavailable	-2

Error Class	Error Description	Value of AI
DataAccessError	hardware-fault	-1
Success	Success	0
Additional Cause	Blocked-by-switching-hierarchy	2
Additional Cause	Select-failed	3
Additional Cause	Invalid-position	4
Additional Cause	Position-reached	5
Additional Cause	Parameter-change-in-execution	6
Additional Cause	Step-limit	7
Additional Cause	Blocked-by-Mode	8
Additional Cause	Blocked-by-process	9
Additional Cause	Blocked-by-interlocking	10
Additional Cause	Blocked-by-synchrocheck	11
Additional Cause	Command-already-in-execution	12
Additional Cause	Blocked-by-health	13
Additional Cause	1-of-n-control	14
Additional Cause	Abortion-by-cancel	15
Additional Cause	Time-limit-over	16
Additional Cause	Abortion-by-trip	17
Additional Cause	Object-not-selected	18

# B


## System Redundancy

This chapter provides additional information on redundant D400 setups. Refer to 2.4 *D400 System Redundancy* for an overview of configuring redundancy.

### B.1 Validating the Redundant Connections

Once you have configured your redundant setup, you should test the system to ensure that redundancy has been properly configured.

» To validate a redundant system:

1. Log into the online HMI of the active D400 unit.
2. Click the  **Point Summary** button on the toolbar.
3. Under the **Application** tab, click the **Details** button for **RedunMgr**.
4. Select the **Digital Input** tab and verify that the points are in the following states:

Point Name	Quality	Value
SystemRedundant	Online	1
StandbyD400CommFail	Online	0
StandbyD400inService Mode	Online	0
StandbyD400NotAvailable	Online	0
D400AActive	Online	1 if you are connected to D400 A 0 if you are connected to D400 B (See note)
D400BActive	Online	1 if you are connected to D400 A 0 if you are connected to D400 B (See note)

Point Name	Quality	Value
Config Sync in Progress	Online	0
Standby Config Out of Sync	Online	0 if both D400s have the same configuration 1 if both D400s have a different configuration

**Note:** If *D400AActive* and *D400BActive* remain fixed at 0 or 1 regardless of the position of the A/B switch on the RS232 panel, ensure that the RS232 adapter cards containing the redundancy control ports are set to the **DTE** position. Refer to *Switch SW1/SW2 Configuration* and *Switch SW3/SW4 Configuration* in the *D400 Substation Data Manager Hardware User's Manual* (994-0089) for more information.

5. Select the **Digital Output** tab and verify that all points are online and have a value of zero.

## B.2 Data Synchronization

The following data is automatically synchronized from the active to the standby D400:

- Accumulator running values
- Local commands that have been applied to individual system points (control inhibit, scan inhibit, local force, etc.).

Data is synchronized between the units through the dedicated serial link. Initial states are synchronized when the active unit first begins to communicate with the standby unit. Once this initial synchronization is complete, individual events are transferred from the active unit to the standby unit as they occur in real-time. The data to be synchronized is stored in the user CompactFlash card of the D400 so that it is not lost in the event that power is interrupted to both units.

The active unit will indicate if the configuration on the standby unit does not match itself via the **Standby Config Out of Sync** digital input.

**Note:** Disabling a device from being scanned using the **DisableDevice** digital output or by using the **Enable/Disable IED** button in the **IED Communication Summary** of the D400 HMI is not synchronized.

Both application configurations (for example, DNP server mappings, LogicLinx programs, etc.) and system configurations (for example, time sync inputs, user logins and passwords, etc.) are synchronized. The only parameters that are not synchronized are IP addresses, as they must be independently configured for each unit (see B.3 *Ethernet Connections*). No other data is synchronized between the two D400s, including system point values, software licenses, or firmware images.

While configuration transfer is in process, the standby unit will not accept any commands from the active unit. The active unit will indicate via the **Config Sync in Progress** digital input when configuration synchronization is occurring. When synchronization is complete, the software on the standby unit will reset in order to

implement all the changes (this is only a software restart, not a reboot of the entire device).

During the reset, the active unit may briefly indicate that the standby unit has failed. If the standby unit remains in failed mode, or if the **Standby Config Out of Sync** digital input does not turn off after the standby unit completes the restart, then the configuration synchronization has likely failed. Check the system and diagnostic logs in both the active and standby units for details on why the synchronization did not complete.

**Caution:** It is extremely important that you do not change the configuration of the active D400 while configuration synchronization is in progress.

B.3 Ethernet Connections

When you configure a pair of D400s for redundancy, you need a total of 3 IP addresses for the two D400s:

- One unique IP address for each D400
- One “active” IP address to be used by the active D400.

The same “active” IP address is configured in both D400s. When a D400 is in active mode, it will use the configured “active” IP address. In any other state, it will use its own unique IP address. This allows external devices and master stations to use only one IP address to access the pair of D400s. Table 156 describes the possible combinations.

Table 156 IP Address Combinations

D400 A		D400 B	
State	IP Address	State	IP Address
■	Active	□	Unique (D400 B)
□	Unique (D400 A)	■	Active
□	Unique (D400 A)	□	Unique (D400 B)
■	Active (See note)	■	Active (See note)

■ denotes active state, □ denotes standby state

**Note:** Having both D400s active at the same time can only be achieved if the two units have not been connected to either the switch or to each other. In any other scenario, the two units will successfully arbitrate so that only one D400 claims the active IP address.

This scheme requires static IP address configuration. The D400 Redundancy solution does not support use of a DHCP server to assign dynamic IP addresses.

If the D400s have a secondary Ethernet interface installed, a second set of 3 IP addresses is assigned to that interface, using the same rules.



## Configuration Synchronization Over Ethernet

All data synchronization normally occurs over the dedicated serial link between the two D400 units. However, if the units can communicate with each other over Ethernet, the standby D400 will attempt to use this connection for faster data transfer when synchronizing the configuration. Refer to the procedure shown under *To Configure Public Key Authentication* in section 8.7 *D400 Configuration Manager*.

## B.4 Error Messages and Troubleshooting

Table 157 describes the possible error messages displayed by the D400 Redundancy Manager. These messages are entered in the diagnostic log of the D400.

**Table 157 D400 Redundancy Diagnostic Error Messages**

Sr. No	Diagnostic log messages	Details
1	b034_active_proc_db_sync() failed with error <error code>	Initial mSQL database synchronization failed. Quality or accumulator records may not have been transferred correctly.
2	Active: failed to pull switch towards	The active unit failed to pull the switch. The RS232 switch panel may not be powered correctly or the connection from the switch panel to the D400 may not be correct.
3	Active: Health CHK failed: Terminating Child	A software error in the D400 Redundancy Manager has occurred.
4	[ACTIVE]: Rejecting command <command type #> because other D400 is in Service Mode	The user issued a command that is not valid when the standby is in Service Mode.
5	[ACTIVE]: Rejecting command <command type #> because activity <activity type> is in progress	The user issued a command that was rejected because another activity was already in progress.
6	[ACTIVE]: Rejecting command <command type> because other D400 is not available	The user issued a command that was rejected since the active cannot communicate with the other D400. The other D400 may have failed or the serial link between the two may be disconnected.
7	[ACTIVE]: CONFIG SYNC activity response timeout waiting for response from standby	Configuration synchronization failed because the standby unit failed to respond to the active. The standby unit may have failed or the serial link between the two may be disconnected.
8	[ACTIVE]: Standby D400 rejected the Config Sync request with reason <reason code>	Configuration synchronization failed because the standby unit issued an error.

Sr. No	Diagnostic log messages	Details
9	[ACTIVE]: Standby D400 failed in Config Sync using network mode	Configuration synchronization in network (Ethernet) mode has failed. The network connection between the D400s may be disconnected, or the public/private authentication keys may not be correctly configured.
10	[ACTIVE]: Tool task failed with error = <error code>	Configuration synchronization failed because the standby unit issued an error. Review the <error code> in the table of Configuration Manager error codes.
11	[ACTIVE]: CONFIG SYNC failed due to tool task timeout	Configuration synchronization failed because the Configuration Manager software failed to respond.
12	[ACTIVE]: Standby D400 rejected the DB Sync start request with reason <reason code>	The standby rejected a request to synchronize either quality or accumulator data. The <reason code> is a technical number with more detail. The most common cause is that the standby unit is in service mode or has failed.
13	[ACTIVE]: Standby D400 failed in DB sync in network mode	Synchronization of either quality or accumulator tables failed to complete. The most common cause is that either communications with the standby unit have been interrupted, or the standby is in service mode or has failed.
14	[ACTIVE]: Response timeout for activity <activity type> subactivity <subactivity type>	The standby unit failed to send a response to the active unit. The numeric codes define the activity that timed out. This is a diagnostic message that only needs to be considered if there are messages indicating that something has failed.
15	[STATE CONFLICT]: BOTH D400s are ACTIVE: Restarting this D400	Check the wiring of the D400 units to the switch panel.
16	[STATE CONFLICT]: BOTH D400s are STANDBY: Restarting this D400	Check the wiring of the D400 units to the switch panel. There could also be loss of power to the switch panel, as a powered-down switch panel reads as "standby" to the D400.
17	Configuration read failed: Entering into Active Non-Redundant mode	Redundancy serial ports are not configured in the connection configuration of the D400.
18	Redundancy is DISABLED: Entering into Active Non-Redundant mode	Diagnostic message only. Redundancy is disabled in the configuration.
19	Failed to open switch panel port: Entering into Active Non-Redundant mode	This message indicates a software failure of the D400. Either the configuration files of the D400 have been corrupted, or the D400 has not started properly.

Sr. No	Diagnostic log messages	Details
20	Failed to open heartbeat port: Entering into Active Non-Redundant mode	This message indicates a software failure of the D400. Either the configuration files of the D400 have been corrupted, or the D400 has not started properly.
21	Error in reading switch panel: Entering into Active Non-Redundant mode	This message indicates a software failure of the D400. Either the configuration files of the D400 have been corrupted, or the D400 has not started properly.
22	Failed to receive initial HB from peer D400: Entering into Active mode	The active D400 never sent a heartbeat message to the standby, causing the standby unit to become active. Check that the active unit is functional and that the serial link between the two units is properly installed.
23	STATE CONFLICT: This D400 = ACITVE and A, PEER D400 = ACTIVE and A Failing this D400	Check the wiring of the D400 units to the switch panel
24	STATE CONFLICT: This D400 = ACITVE and A, Peer D400 = ACTIVE and B Peer D400 should fail	Check the wiring of the D400 units to the switch panel
25	STATE CONFLICT: This D400 = ACITVE and B, Peer D400 = ACTIVE Failing this (B) D400	Check the wiring of the D400 units to the switch panel
26	STATE CONFLICT: This D400 = STANDBY and A, Peer D400 = STANDBY and A Failing this (B) D400	Check the wiring of the D400 units to the switch panel
27	STATE CONFLICT: This D400 = STANDBY and B, Peer D400 = STANDBY Failing this (B) D400	Check the wiring of the D400 units to the switch panel. This could also be loss of power to the switch panel, as a powered-down switch panel reads as "standby" and "B" to the D400.
28	[STANDBY]: Failed to pull the switch, Rejecting Change Over request	The D400 could not pull the switch. Check the wiring of the D400 units to the switch panel. This could also be loss of power to the switch panel.
29	[STANDBY]: Config Sync failed in network mode while copying configuration to /mnt/usr/	The standby D400 unit failed to commit its transferred configuration into the flash card. The flash card may be full or someone may have changed the write permissions on the card. The standby configuration may be partially copied and unusable.
30	[STANDBY]: Config Sync failed in local mode due to tool task failure	Configuration synchronization failed while transferring configuration data. The standby unit uses its original configuration.

Sr. No	Diagnostic log messages	Details
31	[STANDBY]: Config Sync failed in local mode while copying configuration to /mnt/usr/	The standby D400 unit failed to commit its transferred configuration into the flash card. The flash card may be full or someone may have changed the write permissions on the card. The standby configuration may be partially copied and unusable.
32	[STANDBY]: CONFIG SYNC Activity: Tool task timeout in mode <tool task mode>	Configuration synchronization failed while transferring configuration data. The standby unit uses its original configuration.
33	[STANDBY]: CONFIG SYNC Activity: Response timeout	The active unit failed to send a response during configuration sync activity. The active unit may be experiencing problems, or the communication link between the two units may be disconnected. The standby configuration may be partially copied and unusable.
34	Response timeout in DB SYNC Activity	The standby unit failed to send a response while synchronizing quality or accumulator data. The data on the standby unit may not be up to date. The standby unit may be experiencing problems or the communication link between the two units may be disconnected.
35	[ACTIVE]: Config check completed: Configuration is same	The configuration is the same on both active and standby units.
36	[STANDBY]: Response timeout for activity <activity type> subactivity <sbuactivity type>	The standby unit failed to send a response to the active unit. The numeric codes define the activity that timed out. This is a diagnostic message that only needs to be considered if there are messages indicating that something has failed.
37	[ACTIVE]: Switch pulled away: Peer D400 is failed, Failing this D400	Switch pulled manually when the standby unit is not available. The standby unit may have failed or the communication link between the two units may be disconnected.
38	[ACTIVE]: Switch pulled away: Rejecting CHANGE OVER since Other D400 is in Service Mode	Switch pulled manually when the standby unit is in service mode. The active unit rejects the command to switch over.
39	[ACTIVE]: RACE Condition for switch: Failing this (B) D400	Switch was pulled in the last 1000 ms.

Table 158 describes the possible system event messages displayed by the D400 Redundancy Manager. These messages are entered in the system event log of the D400. These are notifications of significant events, not necessarily errors. If it indicates an error or failure, consult the diagnostic log for details.

**Table 158 D400 Redundancy System Log Messages**

Sr. No	System Event log messages	Details
1	Redundancy Manager Started in Active Mode	
2	Switching to standby mode	
3	Sent message to Software Watchdog to RESTART All applications	
4	Sent message to Software Watchdog to STOP All applications	The D400 is being placed in failed mode.
5	Heartbeat(s) received from Standby system :Declaring peer D400 back in Standby State	A lost connection with the standby has been restored.
6	Redundancy Manager Child Started:	
7	Redundancy Manager Application Started	
8	Redundancy Manager Started in Active Non-Redundant Mode	
9	Heartbeat(s) missed from Standby system :Declaring peer D400 as Failed	The standby D400 has stopped responding to communications.
10	Heartbeat(s) missed from Active system :Declaring peer D400 as Failed	The active D400 has stopped responding to communications.
11	Redundancy Manager Started in Standby Mode	
12	Switching from Standby to Active mode	

Table 159 describes the error codes that may be returned by the D400 Configuration Manager.

**Table 159 Configuration Manager Error Codes**

Err. No	Cause
-1	The two D400 units are not already in sync
0	Success
1	Md5sum.txt / tar-zipped file missing in local/tar modes
2	Command line arguments are not proper
3	IP Address or target unit not provided in correct format
4	Validation of transferred configuration files failed
5	Authentication is not set or remote D400 is not accessible
6	Insufficient permissions to read from file
8	Copying of new configuration to /mnt/usr has failed.
20	Configuration is already in sync.

# C

## Remote Authentication

### C.1 Cisco TACACS+

Use the following settings to configure your TACACS+ server for use with your D400.

Table 160 User Account Privilege Levels

D400 Permission Level	TACACS+ Privilege Level
Root	n/a (see note)
Administrator	0 – 3
Supervisor	4 – 7
Operator	8 – 11
Observer	12 – 15

**Note:** Only one root account exists on the D400 and it is stored locally. While it cannot be deleted from the system, you can change the password using the D400 Configuration Utility.

Table 161 TACACS+ Service Parameters

D400 Service	TACACS+ Parameters		
	Service	Protocol	Port
Login	d400local	none	console
HMI Access Manager	d400httpd	none	web
Getty	d400getty	none	ttyS0

D400 Service	TACACS+ Parameters		
	Service	Protocol	Port
Mgetty	d400getty	none	ttyS1
TELNET	d400telnet	none	23
FTP	d400ftp	none	21
SSH	d400sshd	none	22
SFTP	d400sshd	none	22
Terminal Server	d400terminalserver	none	<Port Number>
Pass-through	d400passthrough	none	<Port Number>

## Modification Record

Version	Rev.	Date	Author	Change Description
1.00	0	July 31, 2007	S. Tessari	Document created.
1.00	1	Nov. 14, 2007	M. Haska	Updated Table 62 [Bug #3673], added note regarding upgrade availability, changed "DNP" to "DNP3" throughout.
1.00	2	Dec. 4, 2007	M. Haska	Documented new d400cfg options
		Feb. 6, 2008	M. Haska	Added LogicLinx, MODBUS Client, Hydran Client, MODBUS Server, pass-through connections
		April 30, 2008	M. Haska	Documented licensing tools, rewrote serial connections chapter, updated serial and network connections sections.
2.00	0	June 5, 2008	M. Haska	Updated configuration parameters for DNP3 protocol throughout.
		June 17, 2008	M. Haska	Revised Calculator section for new GUI
2.20	0	September 16, 2008	M. Haska	Updated Serial DNP Master Stations for multiple LRU
2.50	0	October 21, 2008	M. Haska	Added Redundancy Manager, Configuration Manager, IP Changer, and System Status Manager Updated d400cfg section on network interfaces
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2.70	1	Jan. 27, 2009	M. Haska	Minor corrections to Table 161.
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2.75	0	July 22, 2009	M. Haska	Minor corrections to Table 155 note. Added new buttons for One Line Designer tool. Added IEC 60870-5-104 Client.



